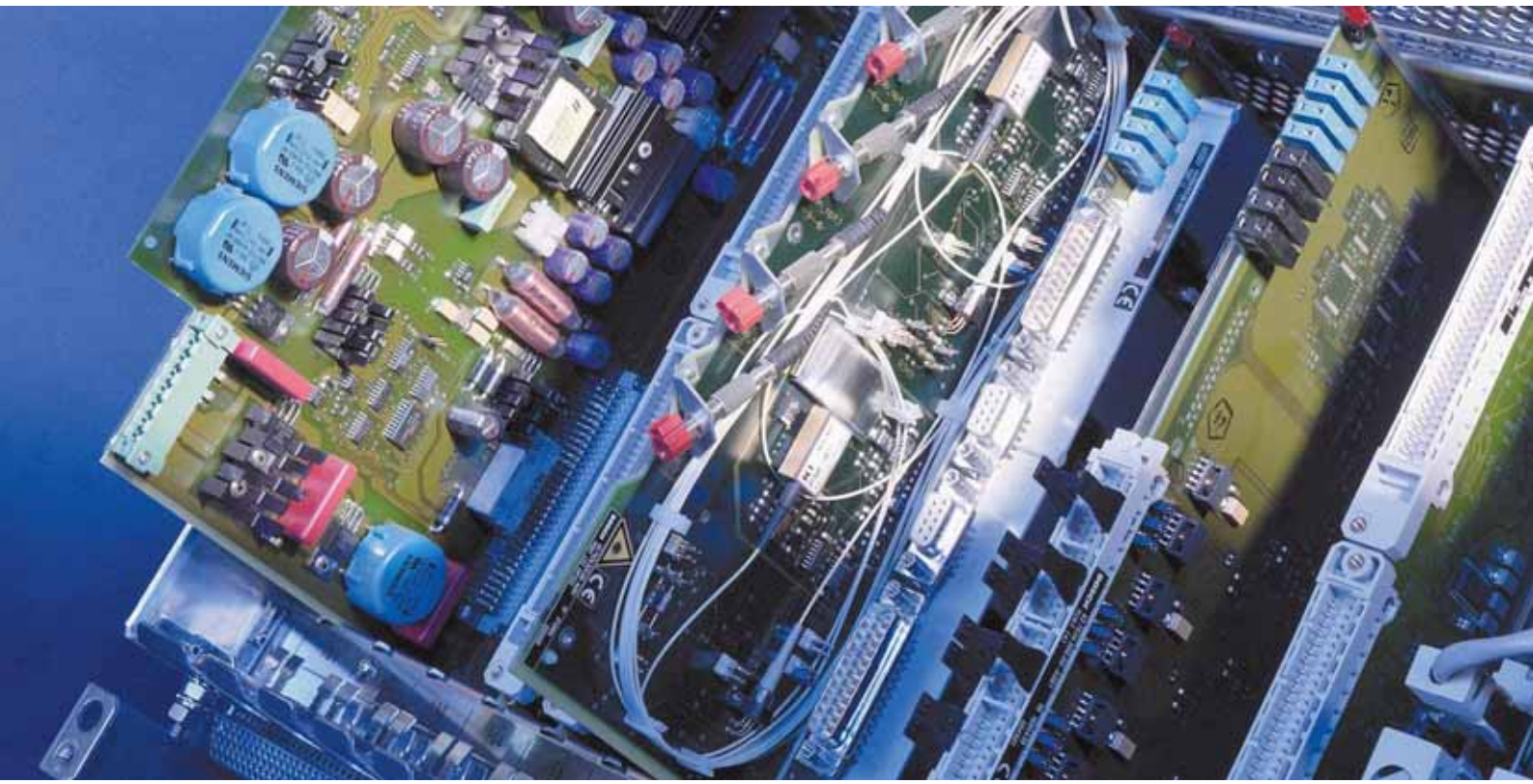

XMP1

XMP1 Release 5.5

System Description

FCD 901 48; Edition: R2A; 07.2009

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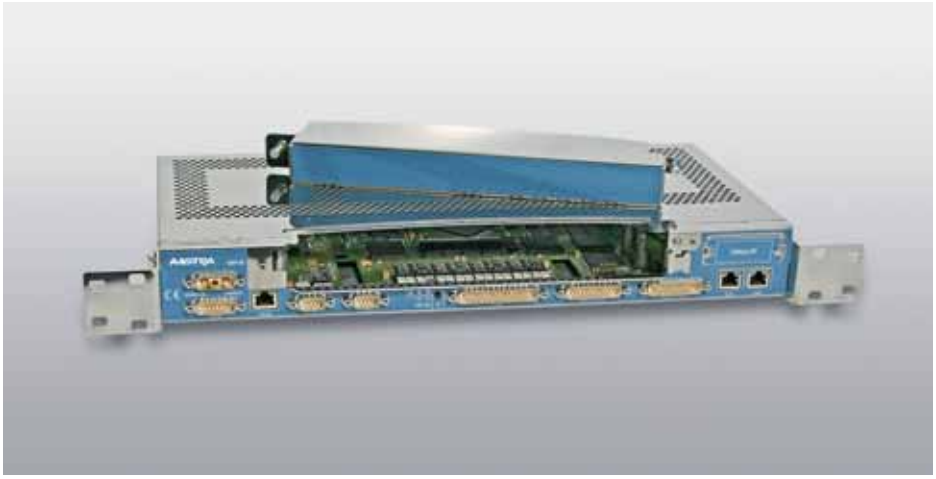
XMP1 subrack with front panel

XMP1 subrack (16), (16 card slots)

XMP1 subrack (8), (8 card slots)



XMP1-SL

Laser Warning

If the XMP1 system is equipped with optical modules, always observe the safety regulations applicable when handling Laser Class 1 systems.

In operation, the equipment units meet the conditions defined for LASER CLASS 1 systems.

The laser is activated as soon as the optical modules are plugged in.

CAUTION! Invisible laser radiation!
Do not look into the coupling points of the fiber-optic cables, especially not with optical instruments.

CAUTION - Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

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Abbreviations

Table 0.A: Abreviations

ABBREVIATION	MEANING
AP	Access Point, Management Access for SOX
B	B Alarm
D	D-Bit, Urgent Alarm
M	Mailing
A	A-Alarm
B	B-Blarm
BER	Bit Error Ratio
B-No.	Trunk Group No.
BW	Design
BW7R	7R Design
CC	Cross-Connect System
CMI	Coded Mark Inversion
COFI	Codec Filter
CRC	Cyclic Redundancy Check
CU	Copper
DC	Direct Current
DCN	Data Communication Network
DKZ	Transit Signalling
DR	Deutsche Reichsbahn
DSK	Data Signal Converter
DTAG	Deutsche Telekom AG
E	Level
E&M	E&M Signalling (Ear and Mouth)
EM	Single-Mode
EM LWL	Single-Mode Fiber
ETx	Receive Clocks at Ports 1 to 16
EX	Exchange
FALC	Framer and Line Interface Unit Component
FEK	Telecommunications Channel
FK	Third-Party Node
FSP	Remote power supply

Table 0.A: Abreviations

ABBREVIATION	MEANING
GF	Optical Fiber
gFa	Complete Firmware, active
gFp	Complete Firmware, passive
GWF	Co-Channel Radio Operation
HDB3	High Density Bipolar of Order 3
HDLC	High Level Data Link Control
HQ	High Quality
IBM	International Business Machine Corporation
ITU	International Telecommunications Union - Telecommunication Standardization Sector
KzK	Signalling Channel
KZU	Signalling Converter
LAN	Local Area Network
LCT	Local Craft Terminal - Local Maintenance and Operator Terminal
LE	Line Terminating Unit
LE CU	Line Terminating Unit for Copper Cables
LE GF	Line Terminating Unit for Optical Fibers
LED	Light-Emitting Diode
LQ	Low Quality
LWL	Fiber-Optic Cable
MCMI	Modified Coded Mark Inversion
MM LWL	Multimode Fiber
MSP	Modular Service PC
MuP No	Multipolling No.
MUX	Multiplexer
MW	Service Digits
N	N-Bit, Non-Urgent Alarm
NF	Voice Frequency
NK	Network Node
NMS	Network Management System
OB	Local Battery
OS/2	Multitasking Operating System
p	Passive Trunk Group
PC	Personal Computer
PCM	Pulse Code Modulation

Table 0.A: Abreviations

ABBREVIATION	MEANING
PeC	Persistance Check
PLL	Phase Locked Loop
Px	Port x, x = no.
Q	Acknowledgement
QuP	Source Port
RAM	Random Access Memory
REP	Repeater
RF	Radio Frequency
RKW	Frame Alignment Signal
S	Card Protection Switching
SD	System Bus
Si and SiII	Signalling Bits for Multiframe Sections
SOX	ServiceOn XMP1, Element Manager
STRV	Power Supply
SUB	Subscriber
Subscr. no.	Subscriber No.
SYN	Synchronization
T3in	External Clock T3, 2048 kHz, input
T3out	External Clock T3, 2048 kHz, output
T8M	8.192 MHz Clock
T8V	8.192 MHz Clock, 90° phase-shifted with respect to T8M
TCP/IP	Transmission Control Protocol/Internet Protocol
TF	Carrier Frequency
TG	Trunk Group
TINT	Internal Clock
TS	Time Slot
V	Preferred Direction
W	19" Subrack
WT	VF Telegraphy
XMP1	Cross-Connect Multiplexer, plesiochronous, 1st hierarchy
ZE	Central Unit Firmware without card firmware
zFa	Central Unit Firmware, active
zFp	Central Unit Firmware, passive
ZG	Central Unit Firmware, complete
ZNK	Central Network Node

Table 0.A: Abreviations

ABBREVIATION	MEANING
ZWR	Repeater

Chapter 1
Introduction to the XMP1 system

This document describes the basic functioning of the XMP1 cross-connect system including its network management options.

1.1 XMP1

The XMP1 system is an integrated flexible platform providing all customary interfaces and functions of a transmission system.

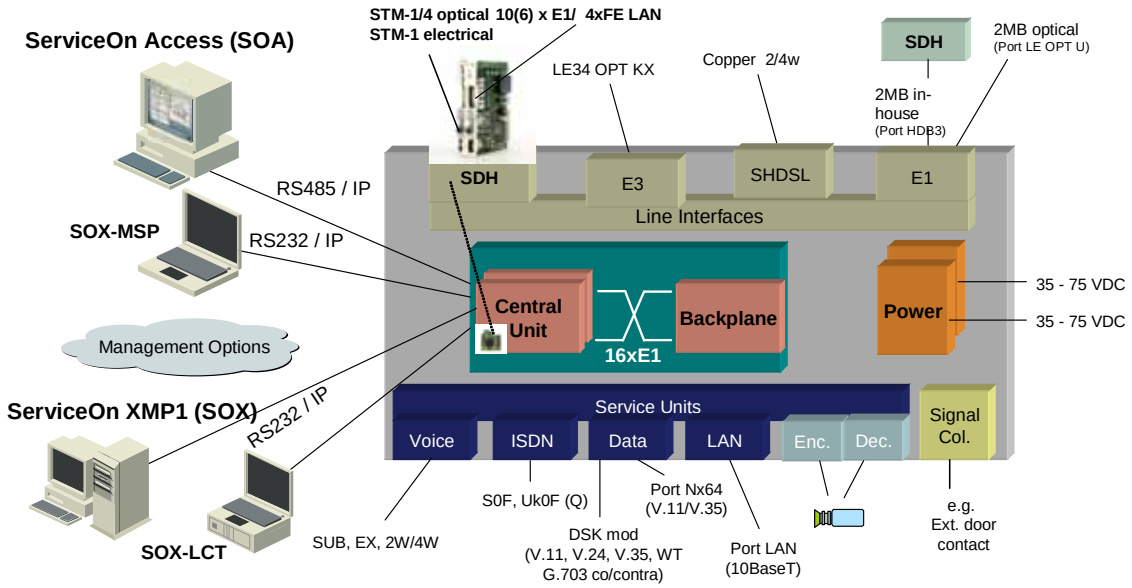
The transmission network is controlled, operated, configured and monitored by means of the Element Manager ServiceOn XMP1 (SOX).

By means of ServiceOn Access (SOA) the transmission network can also be managed.

XMP1 is a modular, flexible and highly integrated cross-connect system used in a network element at the 8/64kbit/s level for the PDH section and at VC-12, VC-3 and VC-4 level for the SDH expansion. The transmission rates can lie between 8 kbit/s and 34 Mbit/s for PDH and STM-1 optical /electrical as well as STM-4 optical for SDH. The Ethernet expansion permits a point-to-point transmission of Ethernet signals between two units equipped with Ethernet interfaces via the SDH network.

The great variety of interfaces and the modular concept permit the setup of new networks and a very economical expansion of already existing networks. Thus, the XMP1 system covers a wide range of applications in both public and private networks.

Since this system can be configured as terminal, add/drop or cross-connect multiplexer, it is appropriate for setting up complex communication and data networks to meet the most different requirements.


ServiceOn Access (SOA)
STM-1/4 optical 10(6) x E1/ 4xFE LAN
STM-1 electrical
LE34 OPT KX
Copper 2/4w
SDH
2MB optical
(Port LE OPT U)
2MB in-house
(Port HDB3)
RS485 / IP
SOX-MSP
RS232 / IP
SDH
E3
SHDSL
E1
Line Interfaces
Central Unit
Backplane
16xE1
Power
35 - 75 VDC
35 - 75 VDC
Management Options
ServiceOn XMP1 (SOX)
RS232 / IP
Service Units
Voice
ISDN
Data
LAN
Enc.
Dec.
Signal Col.
SOX-LCT
SUB, EX, 2W/4W
S0F, Uk0F (Q)
DSK mod
(V.11, V.24, V.35, WT
G.703 co/contra)
Port Nx64
(V.11/V.35)
Port LAN
(10BaseT)
e.g.
Ext. door
contact

1.1.1 Performance features of the XMP1 Flexible Multiplexer

The XMP1 Flexible Multiplexer features the following characteristics:

- Configurable as
  - — Terminal multiplexer,
  - — Add/drop multiplexer or
  - — Cross-connect multiplexer
- System capacity:
  - — 16 x 2 Mbit/s ports
  - — up to 200 subscriber interfaces
  - — configurable for 496 x 64 kbit/s
  - — free time slot assignment
- SDH expansion SCU:
  - — up to 4 x STM-1 optical, STM-1 electrical
  - — maximally 2 x STM-1/4 interfaces per SCU
  - — VC-12, VC3, VC-4 connections
  - — SNCP 1+1, 2 Mbit/s protection (internal), card protection
  - — MSP, Multiplex Section Protection
  - — 10 external E1 interfaces
  - — 8 internal E1 interfaces to the PDH section
- Ethernet expansion EoSCU
  - — up to 4 x Ethernet interfaces
    - GFP, LCAS, VCAT, LLF
    - Auto negotiation
    - Auto MDIX
  - — SFPs for
    - 100Base TX electrical
    - 100Base FX optical
    - 100Base LX optical
  - — up to 2 x STM-1/4 optical, STM-1 electrical
  - — 6 external E1 interfaces
  - — 8 internal E1 interfaces to the PDH section
- Video modules
  - — Video encoder, 2 x video-in
  - — Video decoder, 2 x video-out
- SDSL Line Equipment
  - — 4 SDSL interfaces
  - — 4 external E1 interfaces
  - — 4 internal E1 interfaces to XMP1 kernel
- Possibility of integration in existing multivendor networks

- Frame-synchronous processing of 2 Mbit/s signals; co-channel radio and ripple control signals can thus be transmitted all over the network.
- Network Management with
  - ServiceOn XMP1 Single User and Multi-User version, SOX LCT
  - ServiceOn Access, SOX MSP
- PDA with LSP software (ABM functions)
- Various timing options
  - Clock-synchronous network with external clock (T3in) or internal clock sources (Tint, port receive clock or ISDN interface)
  - Network clock supply in accordance with the priority list
- Redundancy
  - Line and card protection for port modules
  - 64kbit/s Single-channel protection switching
  - Central Unit
  - Power Supply
- Supervision of the transmission quality based on ITU-T Rec. G.821
- 8 kbit/s data multiplexer (CC8) for multiple exploitation of 64 kbit/s channels down to the 8 kbit/s single-bit level
- Great variety of voice (KZU), data (DSK), ISDN and LAN interfaces
- XMP1 subrack installation in 19” and ETSI cabinets or racks
- Compact design

XMP1-SL

The Transport Gateway XMP1-SL (Slim Line) enhance Ericsson’s successful XMP1 platform by a compact universal 1HU cross-connect.

- Space saving by compact-sized 1HU node for 19"/ETSI
- Fully non-blocking 8/64k cross-connect
- Wide range of interfaces of data, voice, ISDN, LAN and Video
- Fully managed via ServiceOn XMP1 (SOX) and ServiceOn Access (SOA)
- Power supply voltage 24/48/60 V DC

The compact Ericsson XMP1-SL provides in its basic equipment grooming and consolidation by 8x E1 and 4x data interfaces. This compact slim line version hosts additionally 1 universal card slot to equip one original XMP1 module.

It shares the advantages of today's successful XMP1 platform along its compactness. This guarantees a seamless integration in existing XMP1 networks as well as stand alone applications.

Setup, configuration and monitoring of networks are fully integrated in the entire Ericsson management platform ServiceOn Access (SOA).

For more detailed information please refer to the Description and Operating Instruction XMP1-SL (05PHA00363AAU).

1.1.2 Interfaces

The XMP1 system offers the user a great variety of interfaces for voice, ISDN, data and LAN services. The interfaces available are briefly described in the following sections.

1.1.2.1 Service Units

Subscriber interfaces for voice (KZU)

KZU FEK
FEK module with 8 interfaces for 2-wire or 4-wire transmission with E&M signalling

- Connection of analog exchanges or CF systems
- Software-controlled level adaptation

KZU OSX
Module with four interfaces, this interfaces can be configured as SUB, EX, OB and OBG.

KZU SUB
SUB module with 8 interfaces for 2-wire connection of CB subscribers (POTS) in the following configurations:

- To exchanges: KZU-EX <-> KZU SUB (subscriber extension)
- As point-to-point connection: KZU-SUB <-> KZU SUB

KZU EX
EX module with 8 interfaces for 2-wire connection to exchanges (POTS extension)

- To exchanges: KZU-SUB <-> KZU-EX (see above)

Subscriber interfaces for data (DSK)

DSK modular - with modules

Modular data interface (basic unit) for equipment with up to four modules.

DSKmod basic unit for a mixed equipment with the following modules:

- V.24 module
- V.11 module
- V.35 module
- WT module

DSKmod basic unit for a mixed equipment with the following modules:

- G703 module with codirectional interface
- G703 module with contradirectional interface

V.11 module

2-port data interface to V.11 (X. 21) with:

- Transparent data bit rate (8, 16... 64 kbit/s oversampling)
- Transmission to V.110, synchronous and asynchronous
- n * 64 kbit/s transmission, synchronous (with n <= 8)

V.24 module

2-port data interface to V.24/V.28 with:

- Transparent data bit rate (8, 16... 64 kbit/s oversampling)
- Transmission to V. 110, synchronous and asynchronous

V.35 module

2-port data interface to V.35 /V.28 with:

- Data bit rate, transparent (8, 16... 64 kbit/s oversampling)
- Transmission to V.110, synchronous and asynchronous
- n * 64 kbit/s transmission, synchrous (with n <= 8)

WT module

2-port data interface for connecting VF telegraphy units:

- Single-current/double-current interface
- Data bit rate up to 9.6 kbit/s, transparent (oversampling)

G.703 module co.

2-port data interface to ITU G. 703, codirectional:

- Synchronous data transmission with a bit rate of 64 kbit/s

G.703 module cn.

2-port data interface to ITU G. 703, contradirectional:

- Synchronous data transmission with a bit rate of 64 kbit/s

Data interfaces (bit rate <= 1984 kbit/s)

Port Nx64

2-port data interface to V.11 or V.35

- Data rate adjustable from 64 kbit/s to 1984 kbit/s in steps of 64 kbit/s

Port LAN

2-port data interface to IEE 802.3

- WAN data rate adjustable from 64 kbit/s to 1984 kbit/s in steps of 64 kbit/s
- 10Base2 and 10BaseT interfaces

ISDN interfaces

All ISDN modules are equipped with four interfaces. The following ISDN point-to-point connection types are being supported:

- 1D/64k (3 x 64 kbit/s)
- 2D/64k (2.5 x 64 kbit/s); D-channels of both interfaces combined
- 3D/64k (2.25 x 64 kbit/s); three D-channels are combined
- 4D/64k (2.25 x 64 kbit/s); four D-channels are combined

ISDN S0F

4-port S0 module with subscriber power supply used for duplex point-to-point connections (4-wire) to I.430

- between ISDN exchanges
- as subscriber extension to a PABX

ISDN Uk0 (Q)

4-port Uk0 module with remote power supply and 2B1Q coding used for duplex point-to-point connections (2-wire echo compensation)

- between ISDN exchanges
- between NTBA and PABX

1.1.2.2 Line Units

2 Mbit/s interfaces (ports) acc. to ITU- T G. 703

Port (2), (4)

Port module with 4 or 2 interfaces for transmission of framed E1 signals

- Electrical 6 dB in-house interfaces, 120 Ω, bal. / 75 Ω, coaxial

Port LE2 OPT U

Modular port module for transmission of unframed/framed E1 signals with two electrical interfaces and two card slots for Module 1F and Module 2F.

- Two electrical 6 dB equipment interfaces, 120 Ω, bal. / 75 Ω, coaxial

Module 1F

- Can be equipped with one or two optical single-fiber interface modules, 1310/ 1550 nm WDM, 25 dB field attenuation (62.7026.580.00-A001/A002)

Module 2F

- Can be equipped with one or two optical 2-fiber interface modules, 1310 nm with 25 dB field attenuation (62.7026.570.00-A001) or 1300 nm with 39dB field attenuation (62.7026.540.00-A001).

34 Mbit/s interface

Port MUX34 KX

Port module with one interface for transmission of framed E3 signals (G.704)

- Electrical 6 dB in-house interface, 75 Ω, coaxial

Interface

- Interface module for connecting 12 external E1 or 3 x E2 signals (8 Mbit/s)

LE 34 OPT KX

- Optical 34 Mbit/s line module E3, 1300 nm.

1.1.2.3 Interfaces for SDH and Ethernet expansion

Up to two SCU or EoSCU modules per XMP1 node.

SCU module (SDH Core Unit)

The SCU module provides two mounting positions for being be equipped with electrical and optical STM1/4 interfaces.

STM-1 interfaces

- Up to two STM-1 interfaces per SCU, 1310 nm and 1550 nm (S1.1, L1.1 and L1.2)
- Up to 2 x STM-1 interfaces per EoSCU, electrical

STM-4 interfaces

- Up to 2 x STM-4 interfaces per SCU, 1310 nm and 1550 nm (S4.1, L4.1 and L4.2)

E1 interfaces

- 10 external E1 interfaces, electrical, to ITU-T G.703 (unstructured and structured to ITU-T G.704)
- 8 internal E1 interfaces to the PDH kernel, acc. to ITU-T G.704

EoSCU module (Ethernet over SDH Core Unit)

The two SDH interfaces and four Ethernet interfaces can be equipped with optical and electrical SFPs.

STM-1 interfaces

- Up to two STM-1 interfaces per EoSCU, 1310 nm and 1550 nm (S1.1, L1.1 and L1.2)
- Up to. 2 x STM-1 interfaces per EoSCU, electrical

STM-4 interfaces

- Up to 2 x STM-4 interfaces per EoSCU, 1310 nm and 1550 nm (S4.1, L4.1 and L4.2)

Ethernet interfaces

- Up to 4 x Fast Ethernet interfaces per EoSCU
  - 100Base TX electrical
  - 100Base FX optical
  - 100Base LX optical

E1 interfaces

- 6 external E1 interfaces, electrical, to ITU-T G.703 (unstructured and structured to ITU-T G.704)
- 8 internal E1 interfaces to the PDH kernel, acc. to ITU-T G.704

CU-E sub-module (Control Unit Expansion)

The Central Unit Expansion (CU-E) sub-module is a pluggable expansion for the Central Unit. It provides the control functions and management interfaces to the SCUs (SDH Core Units) and EoSCUs (Ethernet over SDH Core Units).

- Ethernet interface 10/100BaseT (RJ45 connector) for connecting the network management system via a LAN infrastructure
- Computer for processing management functions
- ECC8 interface for communication with the ZAC-ASIC on the Central Unit
- Internal bus interface for connection to the SCU/EoSCU

1.1.2.4 SDSL Line Equipment

ISHDSL module

- four SDSL interfaces acc. to ITU-T G.991.2
- four external E1 interfaces
- four internal E1 interfaces to XMP1 kernel

RPS-XMP1 Remote Power Supply module

- four Interfaces with Remote Supply Voltage -116 V
- Front cabling with ISHDSL module

SHDSL Repeater

- 1 pair Repeater acc. to ITU-T G.991.2
- Connecting two 2 SDSL links
- Remote powering with RPS-XMP1 module
- Local powering
- Inverse operation possible, e. g. LT/NT interchange
- SW download via Z bit

1.1.2.5 Clock interface T3 and T4

The Central Unit and SCU-E provide the clock interfaces T3 and T4 for applying the 2048 kHz reference frequency and connecting a reference frequency distributor.

1.1.2.6 Power supply interfaces

- 48 V/60 V power supply

1.1.2.7 SDSL interface (external)

Line Termination Unit (LTU) SDSL

- Minirack 1 HU, installation in 19“/ETSI racks
- Tabletop with optional 230V AC power supply
- Subrack 6 HU, installation in 19“/ETSI racks for equipment with 13 LTU modules

1.1.2.8 Video interfaces

The video encoder and video decoder modules are used in the XMP1 system for the transmission of video signals.

- Video encoder
  - 2 x video-in
  - 1 x 2 Mbit/s IF
  - 2 x data IF
- Video decoder
  - 2 x video-out
  - 1 x 2 Mbit/s IF
  - 2 x data IF

- Data rate n x 64 kBit/s (n = 1 to 31 for two IF)
- CIF resolution (288 lines x 256 pixel)
- acc. ITU-T H.261
- Transmission via 2 Mbit/s IF.
  - balanced or unbalanced
  - Data IF for camera control

1.1.2.9 Central Unit interfaces

V.24 interface (F interface)

- Local connection of "ServiceOn XMP1" SOX NMS
- Local connection of the SOX LCT
- Connection of the Local Service PDA.

RS485 interface (QD2-SSt.)

- Connection of ServiceOn Access

Ethernet interface (optional)

Ethernet interface to connect the Central Unit to a LAN. Thus, access to the XMP1 network is possible by **ServiceOn XMP1 (SOX)** and **ServiceOn Access (SOA)** via IP.

Signalling interface

- Display of A and B alarms on the signalling panel of the Central Unit using LEDs. A and B alarms are routed via floating contacts.
- NE Control, 3 input contacts (door contacts), 2 output contacts

Redundancy interface

Connection of a second Central Unit via a specific RJ 45 connecting cable.

1.1.2.10 Signal concentrator

The signal concentrator module provides interfaces (sensors and transmitters) to external units.

Using the sensors, messages received from external devices can be processed. In addition, such external devices can be controlled via the transmitters.

1.1.2.11 Local Craft Terminal SOX-LCT

Local maintenance and operator terminal for on-site use.
The SOX-LCT Local Craft Terminal is connected to the V.24 interface on the Central Unit of the node.

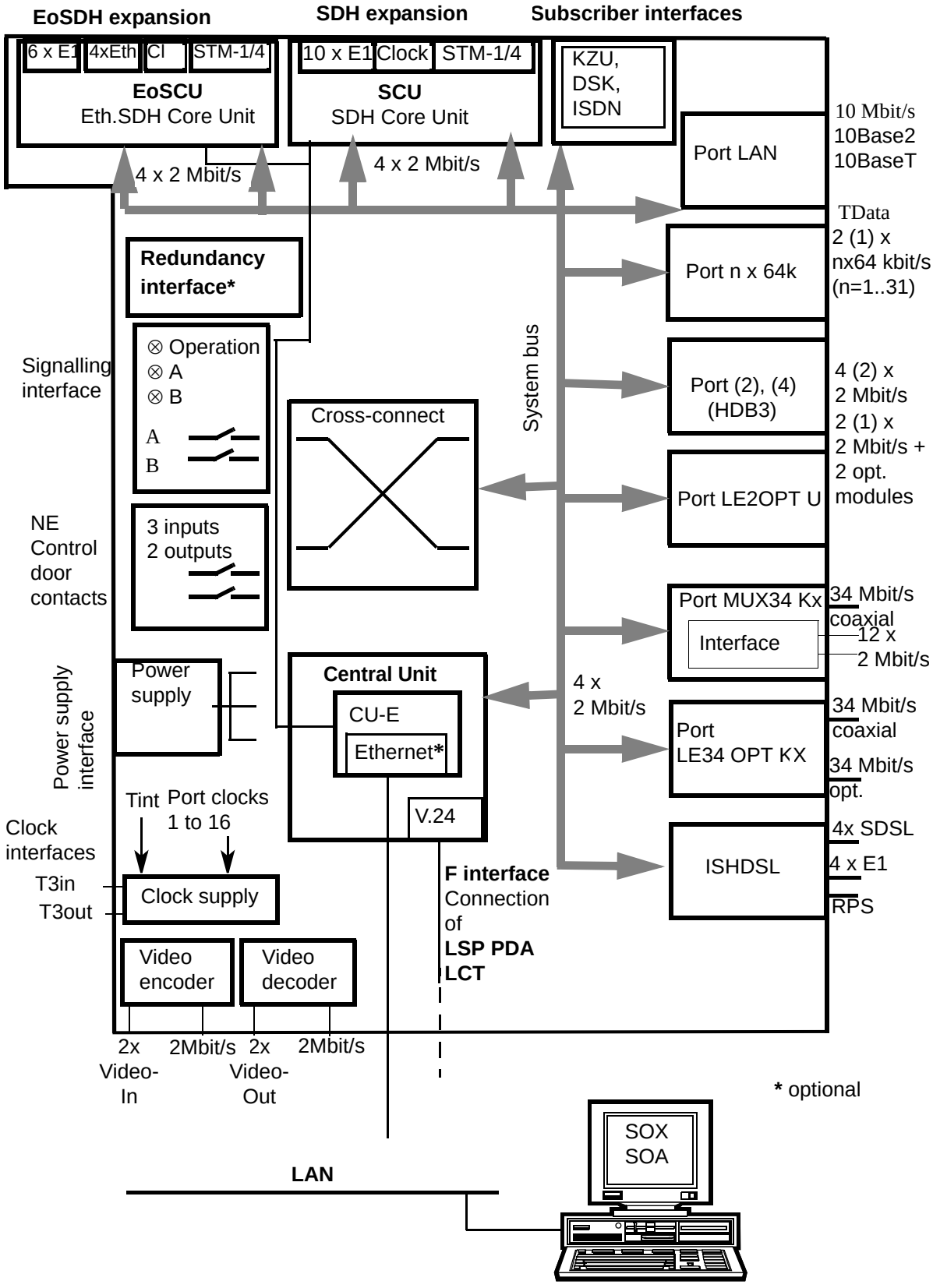


Figure 1.1: Interfaces of the XMP1

1.2 Network Management System

The XMP1 system can be configured, controlled and monitored by two network management systems:

- ServiceOn XMP1 (SOX)
- ServiceOn Access (SOA)

Each NMS provides a local terminal for operation and maintenance.

1.2.1 ServiceOn XMP1 Element Manager

The Management System ServiceOn XMP1 – Element Manager, referred to as SOX in this document, is used to configure, control and monitor XMP1 networks.

SOX is a PC-based system operated under Windows and used to manage pure XMP1 networks or to separately manage XMP1 systems in heterogeneous network applications where further systems are used besides XMP1.

The SOX software is available in two different versions:

- SOX-LCT – as local maintenance and operator terminal for on-site use
- SOX-NMS – for the network-wide configuration, control and monitoring of XMP1 networks

Both versions require a dongle used for operation. Thus, unauthorized access to the XMP1 network is avoided.

All configurations and SW downloads can be performed by the central SOX-NMS.
The initial configuration must be performed using one of the two SOX systems and must be stored in the node. Configurations locally made by means of the SOX-LCT are taken over to the SOX-NMS by reading out the node data.

Both SOX versions are connected via the Central Unit of the XMP1 node. The interface that can be used for this purpose is either V.24 (RS232) or TCP/IP via Ethernet LAN.
The Ethernet interface (TCP/IP) is made available by the Ethernet adapter or - when using SDH modules - by the CU-E sub-module.

The management system architecture for SOX depends on the network size and application. It can be flexibly structured and adapted to the customer’s requirements. Regional, functional and organizatorial aspects can be taken into consideration in the conceptional design.

Basically, the system is divided up as follows:

- Single-user application - Central management structure
- Multi-user application - Distributed management structure

Independent of the respective application, the management channel (DCN) is automatically routed, i.e. in case of an E1 connection, the XMP1 hardware automatically ensures that the management information transmitted in time slot TS0 is always evaluated by the receiving node. In case of several E1 connections between two nodes, the management information contained in time slot TS0 of only one E1 connection is used. In case of an interruption of the channel used to transmit the management information, the management information included in TS0 of another E1 connection is used automatically. This automatic function saves complex planning and definitions for management information routing.

1.2.1.1 SOX Single-User application

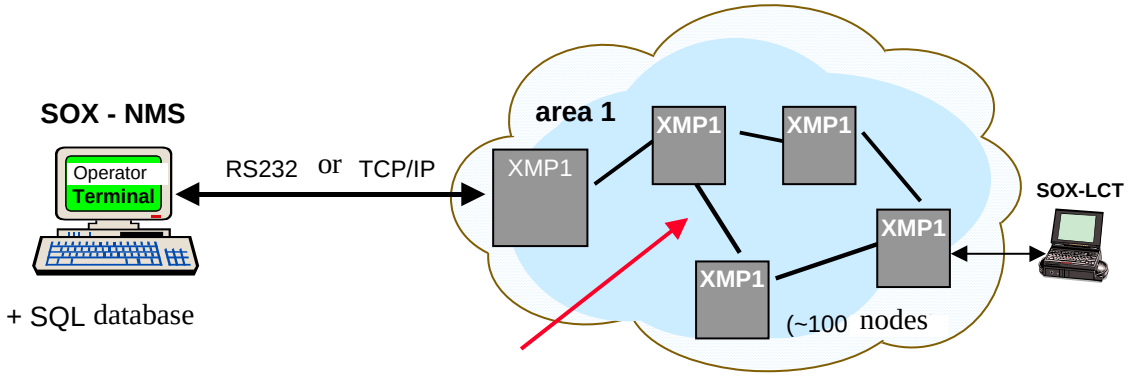
The SOX single-user application is used in networks with typically one user responsible for the overall XMP1 network with about 70 to 100 nodes.

The following system options are available:

- SOX-NMS
- SOX-LCT

SOX-NMS
The components of the **SOX-NMS** - including the operating system, database and SOX software - are installed on a high-capacity PC designed for continuous operation.

SOX-LCT
Using the **SOX-LCT** Local Craft Terminal, changes or requests can be executed at any time for the node physically connected.
The SOX-NMS operator must decide as to whether modifications made shall be activated or not, i.e. he must decide whether the configuration modifications locally entered shall be saved to the database or whether they shall be rejected.

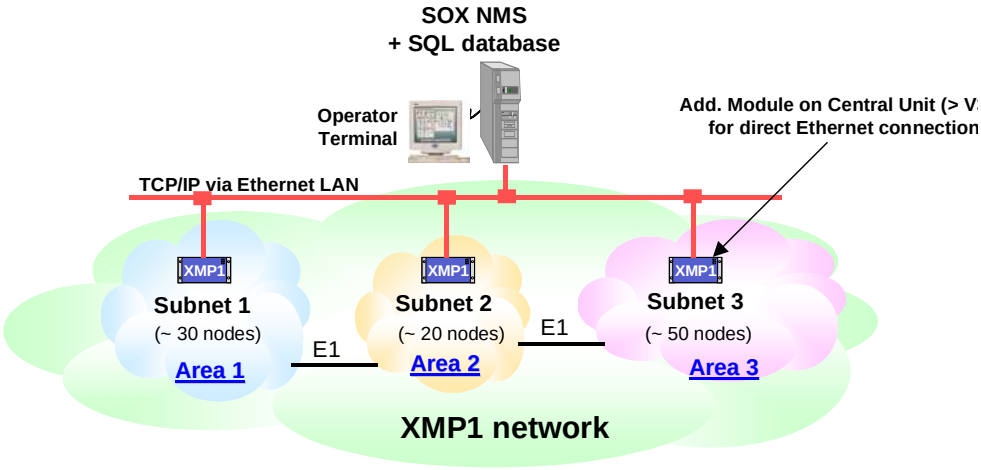


2 Mbit/s connections
TS0 management information

A special variant of the single-user application is the division of a network into several sub-networks (Areas) while maintaining the single-user concept.

Access to an area is possible via V.24 and/or Ethernet interfaces. Access via the Ethernet is recommended. For this purpose, an Ethernet interface must be provided on the Central Unit (> V3.0) of the corresponding access nodes. This Ethernet interface is made available by the Ethernet adapter or - with SDH modules - by the CU-E sub-module.

The overall XMP1 network shown in the diagram below is logically split up into individual sub-networks (Areas) by appropriate segmentation. The individual sub-networks 1, 2 and 3 are still forming the overall network, however, with three separate management accesses. The traffic data are still transmitted between the sub-networks, the managment information contained in time slot 0 being blocked at the area transition of the E1 interface.



1.2.1.2 SOX Multi-User application

The SOX multi-user version permits several users to access the database and XMP1 network simultaneously.

Supported scenarios:

- One user executes the configuration, while others use SOX as alarm monitoring station.
- One user with a low authorization level monitors the alarms. If required, another user with a higher authorization level intervenes.

With the SOX single-user version, only one PC can be connected to the XMP1 network. This primarily represents a network access restriction which only permits a TCP connection.
For the SOX multi-user version, the monolithic single-user application has be divided up into two parts:

- SOX Server
- SOX Clients

SOX Server (Kernel of a multi-user system)

The SOX Server (with SOXKernelService and SoxKernelConsole)) provides the link to the XMP1 network. It is connected to the Database Server and assumes central tasks. In a multi-user system, this SOX Server is required only once for each XMP1 network.
The SOX Server is installed on a Server PC with the Windows 2003 Server Multi-User Operating System. The Multi-User Operating System enables several users (up to 5 SOX Clients) to start a Windows user session on the Server PC. Normally, the Database Server is also on this Server PC. However, the Database Server can also be installed on another PC. The SOX Server and Database Server are implemented as Services at the "Windows Service Level".

SOX Client (PC of a multi-user system)

In conjunction with a SOX Server, the SOX Client is used to monitor and configure a XMP1 network. The SOX Client PC provides the user interface required for this purpose. It is possible to provide several SOX Clients. The SOX Client is started in a Windows user session. This Windows user session can be executed on the Server PC or a Client PC.

Both the SOX Server and SOX Client are using the common Database Server. The SOX Server receives - for example - alarms, saves these to the database and informs the SOX Clients. Using SOX Clients, it is possible to create new network elements in the database. In this case, the SOX Server is informed, updates its data from the database and forwards the corresponding information to the other SOX Clients.

The following diagram shows a logic view of the SOX multi-user system The SOX Client, SOX Server and Database Service communicate with each other via a TCP connection.

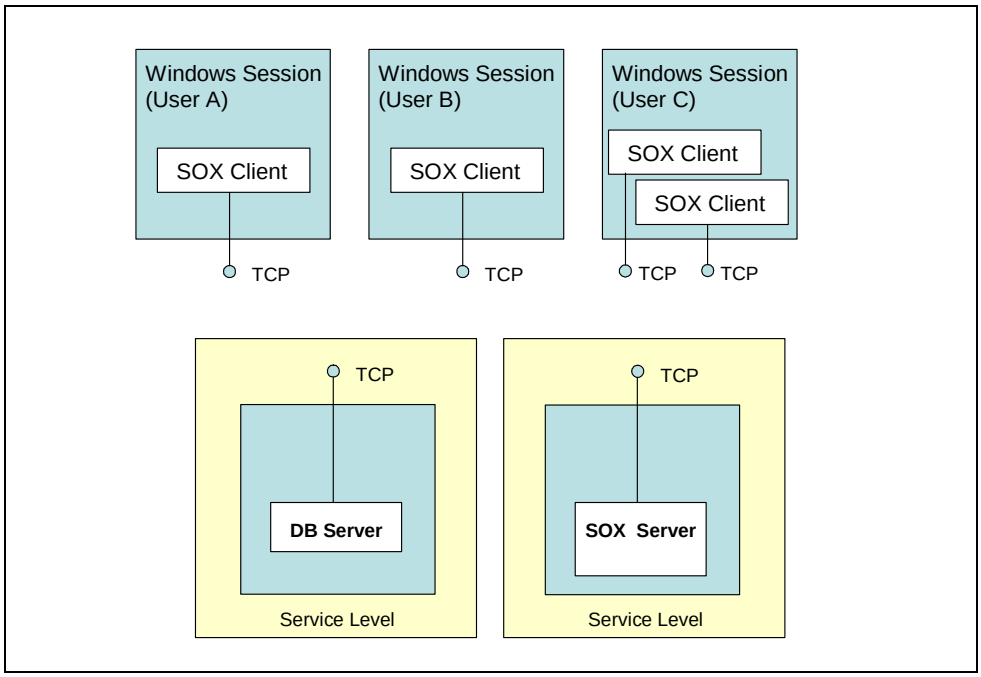
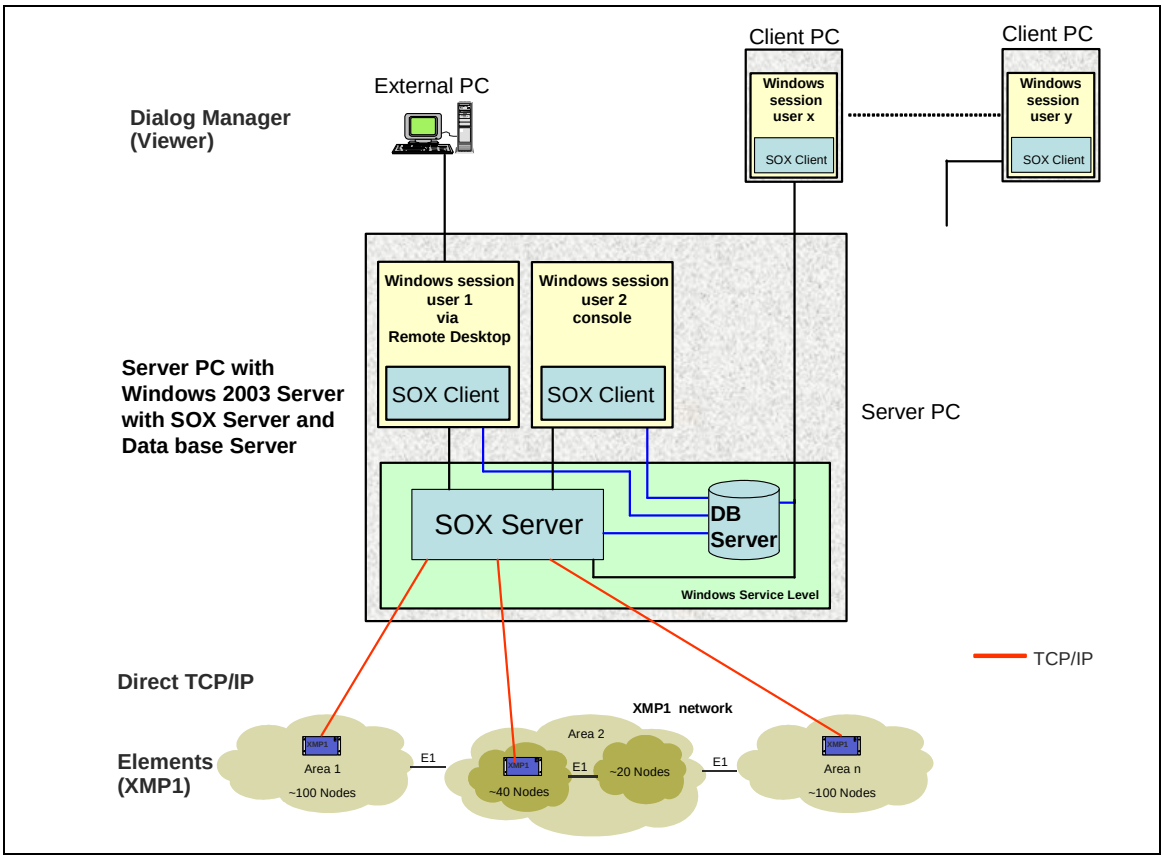


Figure 1.2: Logic view of the SOX multi-user system

Communication between the SOX Clients and SOX Server requires a quick and reliable TCP connection. Its use in a Wide Area Network (WAN) is not supported directly. For this purpose, another session must be started by an external PC for the Server PC using the "Remote Desktop" option. In this session, the SOX Client is locally run on the Server PC, while WAN traffic is handled by the "Remote Desktop".

The following drawing shows how the logic view depicted in Fig. 1.2 could be implemented in a hardware configuration. In this example, the SOX Server and Database Server are installed on one Server PC with the Windows Server 2003 Operating System. An external PC permits access via the "Remote Desktop" option. Two Client PCs also allow access to the XMP1 network.


Client PC
Client PC
External PC
Dialog Manager
(Viewer)
Windows session user x
SOX Client
Windows session user y
SOX Client
Windows session user 1 via Remote Desktop
SOX Client
Windows session user 2 console
SOX Client
Server PC with Windows 2003 Server with SOX Server and Data base Server
Server PC
SOX Server
DB Server
Windows Service Level
TCP/IP
Direct TCP/IP
XMP1 network
Elements (XMP1)
Area 1
~100 Nodes
E1
Area 2
~40 Nodes
E1
~20 Nodes
E1
Area n
~100 Nodes

1.2.2 ServiceOn Access Network Management System

Optionally, it is possible to connect the ServiceOn Access System via the QD2 interface. Thus, XMP1 can be integrated into the management of large-scale heterogeneous networks. All necessary control and monitoring functions are implemented.

With XMP1 version 5.0 and higher, the SOX-MSP must be used for local configuration.
For more detailed information please refer to the "ServiceOn Access" and "MSP" documents.

Chapter 2
Functioning

The XMP1 Flexible Multiplexer digitizes and multiplexes both voice and data information from subscribers. The data are transmitted to the XMP1 network and can be read, demultiplexed and sent again to the subscribers in each XMP1 node.

2.1 General Functions

Transmit direction

In the transmit direction, the voice information to be transmitted is digitized. In doing so, it is subjected to a quantization and transmitted as 8 bit word via the system data bus at 2 Mbit/s.
The system data bus is a 32 Mbit/s data bus. It is 8 bit wide and divided into 512 time slots.
The entire information of the system data bus is available at each module. The information as to when a module can extract the 64 kbit/s data from or insert them into the system data bus is contained in the allocation memories of the individual modules.
The channel module transmits the 64 kbit/s data in the time slot assigned to it on the system data bus.
The port module now extracts the 64 kbit/s data of the channel module from the system bus and sends them to the multiplexer.

In the transmit direction, the multiplexer on the port module combines 30 digital signals of 64 kbit/s each + 2 kbit/s or 31 x 64 kbit/s digital signals to one 2.048 Mbit/s signal.
The digital signals are multiplexed in the allocated time slots defined by the PCM frame structure. The allocation between time slots and 64 kbit/s signals is freely selectable.
For synchronizing the demultiplexer of the opposite station, a frame alignment signal is inserted in the bit stream.
The F1 interface performs the conversion to the line code and matches the signals with the transmission medium used.

The F1 interface can be designed as

- HDB3 code equipment interface (Port (2), (4))
- line interface for copper cables (LE port) or
- line interface for optical fiber cables (LE2 OPT U port).

Receive direction

In the receive direction, the 2 Mbit/s signal received at F1in is regenerated on the port module. The receive signal is used to recover the 2 MHz receive clock and the receive code is converted again into its binary form. The

demultiplexer synchronizes itself to the frame alignment signal and applies the 64 kbit/s signals to the system data bus.
Controlled by the central control module on the Central Unit, the channel modules now extract their 64 kbit/s signals from the system data bus.
The COFIs on the channel modules convert the digital signals again into analog signals and transmit them to the subscribers.

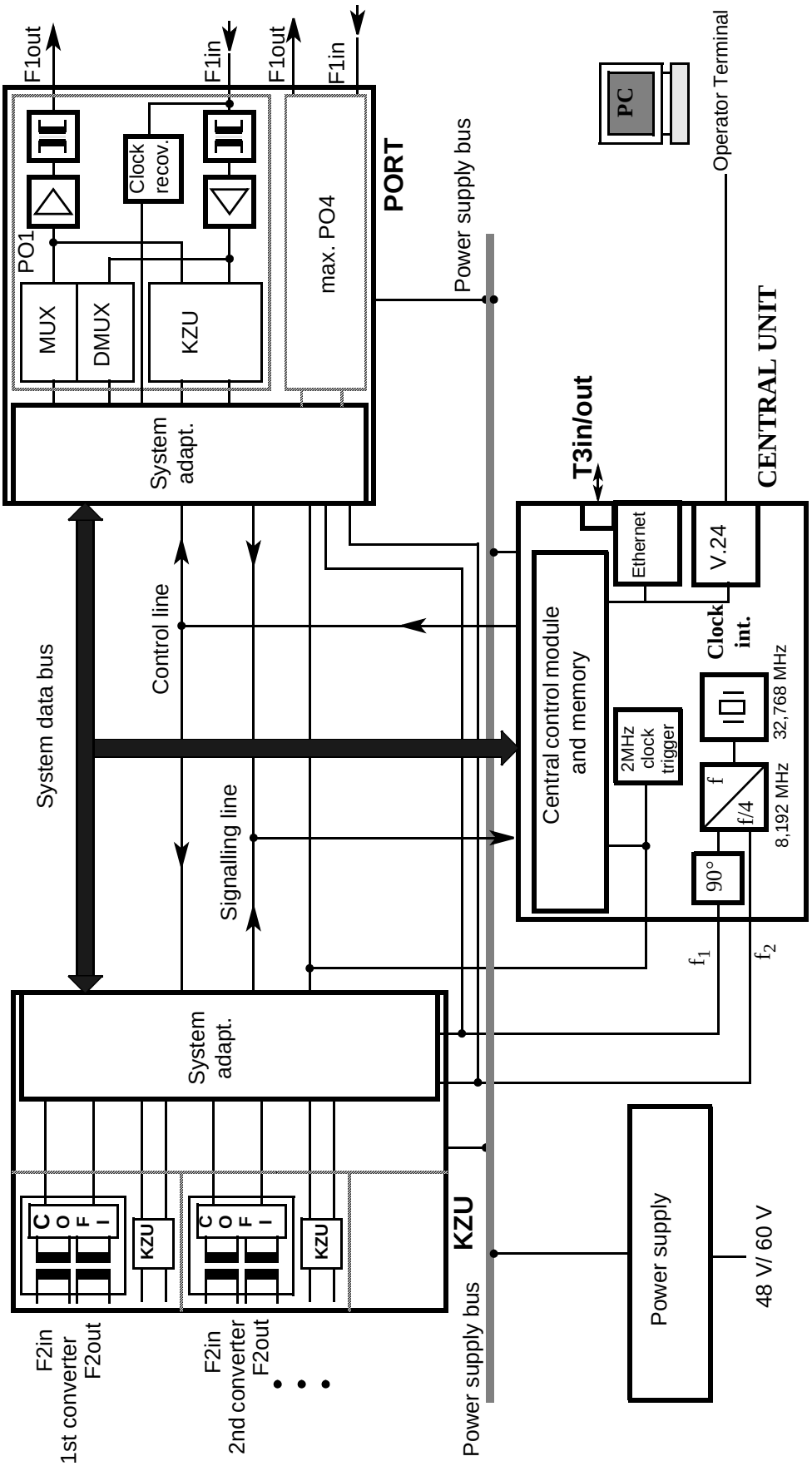


Figure 2.1: Block diagram of the XMP1 Flexible Multiplexer

2.2 Frame Structure and Synchronization

2.2.1 Frame structure

In the time-division multiplex procedure, the analog signals to be transmitted are first sampled, quantized and encoded. These analog signals are telephone signals (limited from 300 Hz to 3400 Hz) which are sampled at a rate of f_A = 8000 Hz, i.e. the amplitude of the analog signal is sampled once every 125 µs.

The sampling results are quantized and encoded to form 8-bit words. This pulse code modulation (PCM) has a bit rate of 64 kbit/s. Since the bandwidth of the transmission paths is considerably wider than that required for this bit rate, several PCM signals can be combined to a PCM multiplex signal of a higher bit rate. The encoded sampling values of the different input signals are thus transmitted one after the other.

The XMP1 system is appropriate for handling signals of both KZU and DSK modules.
It combines 30 x 64 kbit/s digital signals (channels) + 2 kbit/s or
31 x 64 kbit/s digital signals to one PCM 2.048 Mbit/s multiplex signal on the ports.

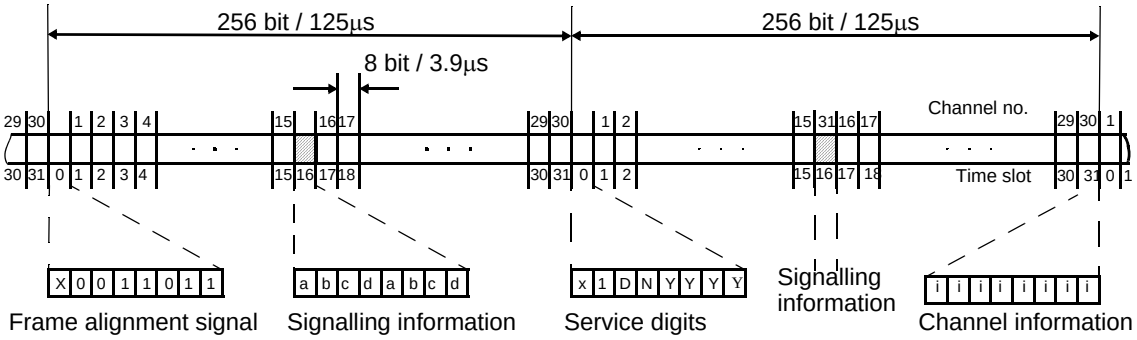
Each 125 µs frame transmits 32 channels, 8 bits being allocated to each of them.
30 (31) of these 32 channels available are used for transmitting traffic information. Two channels are required for transmitting the frame alignment signal or service digits and signalling information.

The first time slot (time slot 0) of the frame includes the frame alignment signal and service digits by turns. The frame alignment signal is required for synchronizing the transmit and receive sections of the PCM transmission system. The service digits include information on fault conditions and bit error ratios.
The signalling information is transmitted in time slot 16 of each pulse frame. It includes the signalling pulses for two voice channels. Thus, 15 frames are required for transmitting the signalling information of all voice channels. A total of 16 frames are combined to one multiframe, the additional frame available being required for transmitting the multiframe alignment signal and service digits.

The multiframe has a duration of 16 x 125 µs = 2 ms.

The pulse frame is in compliance with ITU-T Rec. G.704.

Pulse frame



Multiframe structure

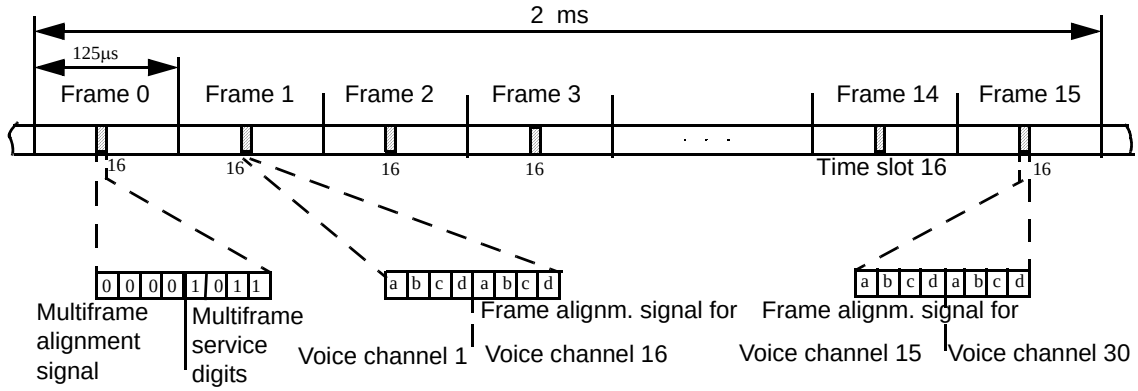


Figure 2.2: Frame structure

Frame

Frame alignment signal

The frame alignment signal required for synchronization is transmitted in time slot 0 of every other frame.

Table 2.A: Frame alignment signal

Bit position	1	2	3	4	5	6	7	8
Binary value	X	0	0	1	1	0	1	1

Bit X in position 1 is used for transmitting the CRC4 bits.

If the CRC4 procedure is not applied, bit X is set to logic 1.
The bits in positions 2 to 8 define the binary values of the synchronization pattern.

Service digits

The service digits are transmitted in the frames which do not include the frame alignment signal.

Table 2.B: Service digits

Bit position	1	2	3	4	5	6	7	8
Binary value	X	1	D	N	Y	Y	Y	Y

Bit X in position 1 is used for transmitting the CRC4 multiframe alignment signal. If the CRC4 procedure is not applied, bit X is set to logic 1.
The bit in position 2 is set to logic 1 in order to avoid that the service digits can pretend to include a frame alignment signal.
Bit D in position 3 is required for signalling an urgent alarm (alarm = 1).
Bit N in position 4 is used to signal a non-urgent alarm (alarm status =1).

The Y-bits (Sa bit) in positions 5 to 8 are used as system channel and control channel for network configuration and network surveillance.
The Y- bit (Sa bit) in position 5 is required to control the clock priorities in an XMP1 network.
The Y-bits (Sa bit) in positions 7 and 8 are used to transmit the system channel.

XMP1 permits the Y-bits (positions 5 to 8) to be re-routed via traffic channel 29. In this case, they can be used to transmit the system channel of third-party units.

Multiframe

Signalling transmission

The signalling information for the 30 channels available on each port is digitized on the channel modules and transmitted in time slot 16.
The multiframe includes sixteen 8-bit signals which are transmitted in time slots 16 of the multiframe. The duration of the multiframe is 2 ms, i.e. it is 16 times longer than a single multiplex frame. The 16 frames included in a multiframe are numbered from 0 to 15.

Frame 0

In frame 0 of the multiframe, the multiframe alignment signal (4 bits) is transmitted in bit positions 1 to 4, whereas the multiframe service digits (4 bits) are transmitted in positions 5 to 8.

Table 2.C: Frame 0

Bit position	1	2	3	4		5	6	7	8
Binary value	0	0	0	0		Y	Dk	Y	Y

Frames 1 to 15

Frames 1 to 15 transmit the signalling information of the 30 individual channels
(4 bits per channel). In these frames, the frame alignment signals for traffic channels 1 to 15 are transmitted in positions 1 to 4, those for traffic channels 16 to 30 in positions 5 to 8.

Table 2.D: Frames 1 to 15

Position	1	2	3	4	5	6	7	8
Bit designation	a	b	c	d	a	b	c	d
Signalling for traffic channel	n				n+15			

The following table shows the allocation of the individual frames to traffic channel signalling.

Table 2.E: Allocation of the individual frames to traffic channel signalling

Frame	Signalling for traffic channel
1	1 and 16
2	2 and 17
3	3 and 18
4	4 and 19
5	5 and 20
6	6 and 21
7	7 and 22
8	8 and 23
9	9 and 24
10	10 and 25
11	11 and 26
12	12 and 27
13	13 and 28
14	14 and 29
15	15 and 30

2.2.2 CRC4 procedure

The CRC4 procedure (CRC= cyclic redundancy check) is used

- to avoid malsynchronization due to pretended synchronization patterns (pretended frame alignment signals)
- and to detect even low bit error ratios (BER = 10^{-6}).

The so-called CRC4 signature consists of four bits referred to as C1, C2, C3 and C4. These four bits are determined using the CRC4 algorithm.

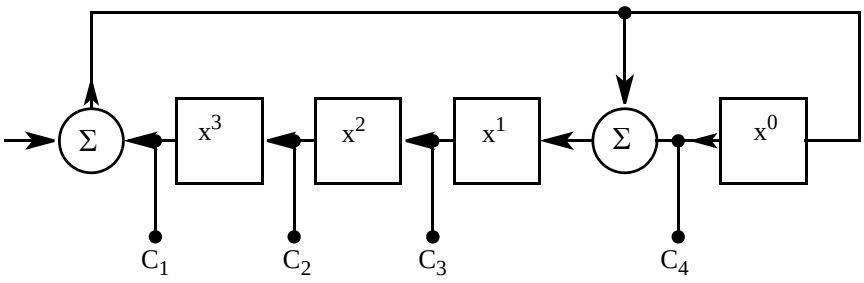
CRC4 algorithm

The four bits C1, C2, C3 and C4 of the CRC4 signature are calculated over a data block of 8 frame lengths (2048 bits) using the CRC4 algorithm and are transmitted in the next multiframe.

In this calculation, the data block is considered as polynomial in x, the coefficients of which can assume the values 0 or 1.

The first data bit corresponds to the coefficient of the highest power in x. The data block is first multiplied by x4 and then divided by the polynomial x4 + x + 1 (exclusively modulo 2 operations). The remaining value forms the C1, C2, C3 and C4 signature, C1 being the most significant bit.

Figure 3-3 shows the circuit required for this operation.



The circuits referred to as x0 to x3 are 1-bit shift registers.

Figure 2.3: Circuit for implementing the CRC4 algorithm

All 2048 bits of the multiframe are involved in this operation. Each step produces a bit combination (C1 to C4). However, the correct CRC4 signature is available at outputs C1 to C4 only after all 2048 bits have been passed through the circuit.

CRC4 frame structure

The multiframe for the cyclic redundancy check (CRC) is composed of 16 frames. This multiframe is divided into section I and section II, each being composed of 8 frames. Thus, one multiframe section includes 2048 bits. It forms one block for the redundancy check.

Figure 3-4 below gives a detailed overview of the CRC4 multiframe.

Bit X in position 1 of the frame alignment signal is used to transmit the CRC4 signature (C1, C2, C3 and C4). The four CRC bits are transmitted serially in this position. Thus, four (4) frame alignment signals are required for transmitting one CRC4 signature.

Bit X in position 1 of the service digits is used to transmit a CRC4 multiframe alignment signal.

Table 2.F: CRC4 frame structure

	Multiframe	Frame	Bits 1 to 8 of time slot 0 of a frame								
			1	2	3	4	5	6	7	8	
CRC4 multiframe	I	0	C1	0	0	1	1	0	1	1	RKW
		1	0	1	D	N	Y5	Y6	Y7	Y8	MW
		2	C2	0	0	1	1	0	1	1	RKW
		3	0	1	D	N	Y5	Y6	Y7	Y8	MW
		4	C3	0	0	1	1	0	1	1	RKW
		5	1	1	D	N	Y5	Y6	Y7	Y8	MW
		6	C4	0	0	1	1	0	1	1	RKW
		7	0	1	D	N	Y5	Y6	Y7	Y8	MW
	II	8	C1	0	0	1	1	0	1	1	RKW
		9	1	1	D	N	Y5	Y6	Y7	Y8	MW
		10	C2	0	0	1	1	0	1	1	RKW
		11	1	1	D	N	Y5	Y6	Y7	Y8	MW
		12	C3	0	0	1	1	0	1	1	RKW
		13	SiI	1	D	N	Y5	Y6	Y7	Y8	MW
		14	C4	0	0	1	1	0	1	1	RKW
		15	SiII	1	D	N	Y5	Y6	Y7	Y8	MW

SiI, SiII: Signalling bits for multiframe sections I and II.
D: Service digit, urgent alarm
N: Service digit, non urgent alarm
Y: Control and signalling bit
C1, C2, C3 and C4: 4 CRC-bits (Cyclic Redundancy Check)
RKW: Frame alignment signal
MW: Service digits

Figure 2.4: CRC4 frame structure

Transmission and evaluation of the CRC4 signature

The calculated CRC4 signature is stored before it is sent to the receive side via the next multiframe section. The CRC4 signature bits C1 to C4 are transmitted in bit positions 1 of the frame alignment signals of the frames 0, 2, 4, 6 and 8, 10, 12, 14 respectively.

On the receive side, the CRC4 signature is calculated from the received bit stream and compared with the CRC4 signature received in the next multiframe. If these signatures are not identical, at least one bit error has occurred in the multiframe section concerned.

All CRC4 signature errors detected are permanently counted and added up. If more than 914 such errors occur in one second, the frame must be resynchronized.

This signature comparison is no longer performed on loss of sync of the frame or CRC4 multiframe.

2.2.3 Synchronization

Frame alignment

Frame alignment is performed using the synchronization pattern (bits 2 to 8 of the frame alignment signal, bit 2 of the service digits) or optionally using the multiframe and/or CRC4 procedure.

The synchronization process starts with the search for the frame alignment signal (bits 2 to bit 8) in the receive frame. As soon as the frame alignment signal has been found, it is checked whether bit 2 of the service digits contained in the next frame is logic 1. If this is the case and if the frame alignment signal is identified again in the following frame, the frame synchronization process is terminated.

Synchronization to the multiframe is terminated as soon as the multiframe alignment signal has been correctly received in frame 0 and no other multiframe alignment signal is detected in the following 15 frames (1 to 15).

In order to avoid that the absence of the frame alignment signal (continuous 0) pretends a "multiframe in sync" status, one or several frames (1 to 15) are additionally monitored for the presence of bits with the binary value 1. If no such bits can be found, the multiframe is out of sync.

Persistence check

In order to avoid bit errors on the transmission link, a persistence check is performed, i.e. the information of the individual signalling bits (continuous "0") transmitted in the signalling channel of two consecutive multiframes is compared. A change of the information value is accepted and passed on to the signal processing circuit only when both values are identical.
As soon as the signalling converter receives a wrong multiframe alignment signal, changes of the information status of the individual signalling bits are not evaluated until the multiframe alignment signal has been received again correctly, i.e. the multiframe is again in sync.

Loss of sync

When the frame alignment signal has been received incorrectly three times in a row, the frame alignment process is reinitiated. The evaluation can also involve bit 2 of the service digits, i.e. if this bit has been received as logic "0" three consecutive times, the frame is considered to be out of sync.

Frame realignment

If the frame alignment signal has been identified for the first time and bit 2 of the following frame 0, i.e. one frame duration later, is logic 1, and the frame alignment signal is found again in the next frame, the synchronization process is terminated successfully.

If during the synchronization process
- the frame alignment signal has been identified for the first time and one frame length later,
- if binary value 0 has been identified in time slot 0 of bit position 2, or
- if the frame alignment signal has been identified for the first time and cannot be found again two frame lengths later, a new synchronization process will be initiated two frame lengths after having identified the frame alignment signal for the first time.

Frame alignment using the CRC4 procedure

When using the CRC4 procedure, frame alignment is performed as follows:

- Synchronization to the frame alignment signal of the frame
- Synchronization to the frame alignment signal of the CRC4 multiframe.

While the system is in sync, the frame alignment is permanently monitored and faults detected during the CRC4 signature comparison are counted.

If frame alignment gets lost or if more than 914 CRC4 errors are counted within one second, a new synchronization process is initiated.

This latter is started by searching for the frame alignment signal.
As soon as it has been found, it is checked whether bit 2 of the service digits occurring in the next frame is logic "1".
In this case and if the frame alignment signal is identified again one frame length later, the frame alignment process is terminated successfully.

Now the system searches for the CRC4 multiframe alignment signal. Sixteen frames (2 ms) are required for transmitting the latter. It is checked within an interval of 8 ms, whether at least two CRC4 multiframe alignment signals can be identified in the 2 ms pattern. If not, the synchronization process will be restarted. This procedure prevents the system from being synchronized to incorrectly pretended frame alignment signals or service digits.

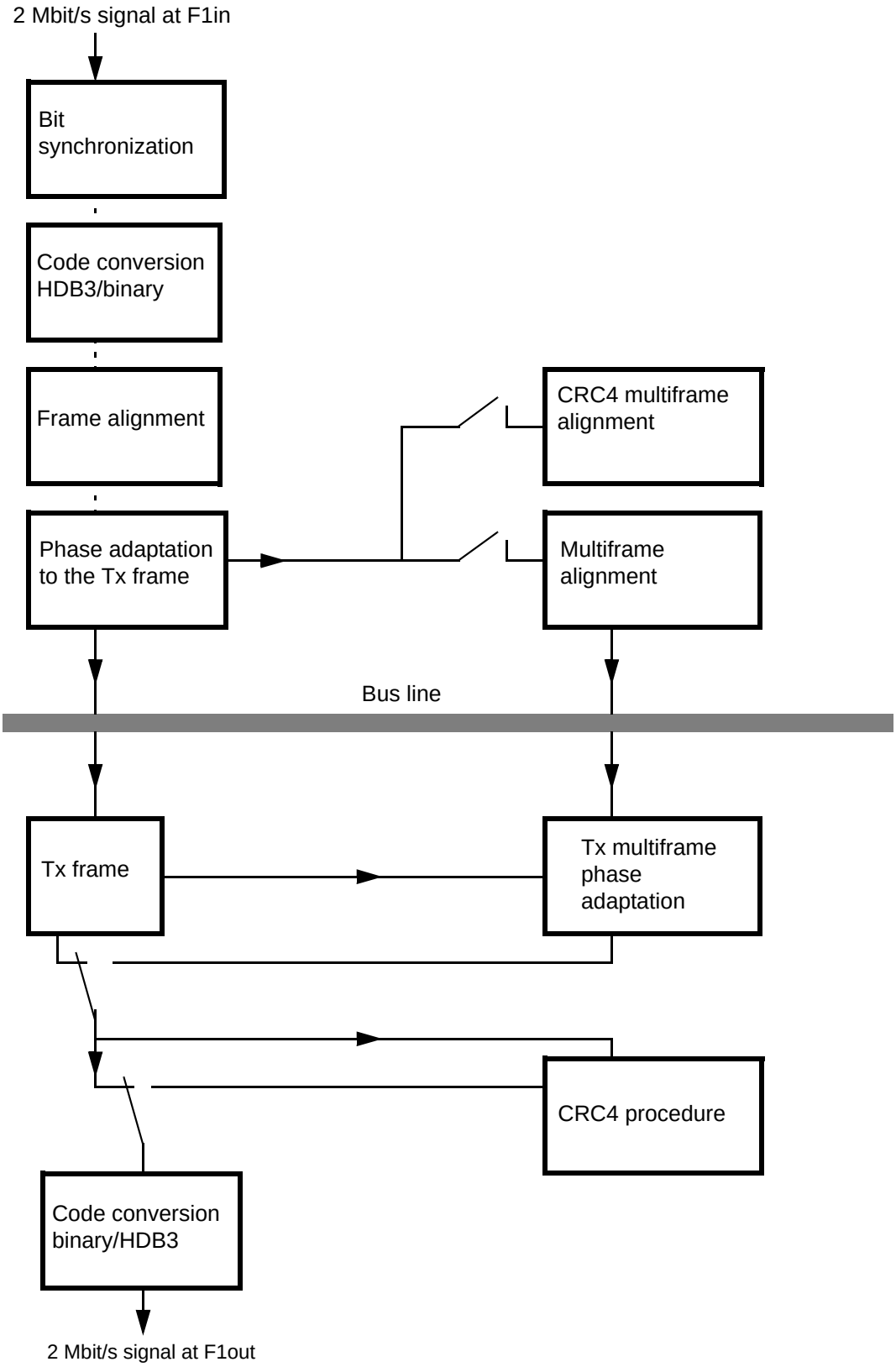


Figure 2.5: Synchronization procedure

2.3 Clock Supply

The PCM network represents a synchronous network. In such a network, a network node can supply the network clock. If this network clock source fails, another network node must take over network synchronization.

However, it is also possible that individual or all network nodes recover their clock from T3in or use an Rx clock.

In the standard procedure of the XMP1 system, a network node provides the clock for all other network nodes (see Section 2.3.3, *Clock priority control*).

To increase clock supply flexibility in the network, the XMP1 system offers further clock control options:

- Separation of clock ranges at different connections
- Clock supply regionalization (using debugging functions)
- Manual entry of clock trees
- Preferred or fixed connection of individual nodes to specified clock sources

The clock sources available for network synchronization are recorded and administered by the Network Management software. The Network Management software also informs the network node on its clock sources and numbers of its clock priorities.

2.3.1 Clock sources

The following clock sources can be used:

- internal clock T_{INT}
- external T3in clock
- receive clocks of port modules
- receive clock of ISDN interfaces
- SDH clock

Clock generator 2.048 MHz

A clock generator with a frequency of 2.048 MHz is used as internal source for system clock supply.

Clock interface T3in

Clock interface T3in can be used to supply the XMP1 Flexible Multiplexer with the 2048 kHz reference frequency required for synchronous operation. The input impedance of the T3in interface is $\geq$1.6 KOhms $\leq$ 16 pF. In order to avoid reflections on the clock line, the input can be terminated with 120 Ohms.

The clock interface T3out (output) is used to connect a reference frequency distributor.

The ports of clock interfaces T3in and T3out (T4) are implemented on a 9-pin D-Sub connector (male) of the Central Unit or - with the SDH expansion - on the the SCU module.

Receive clocks at ports

The 2 Mbit/s signals available at F1 inputs of the ports are used to recover the receive clock. For this purpose, the ports transmit their F1in sum signal via the TE clock line to the Central Unit. In doing so, they are controlled by the clock priority. In the Central Unit, the clock is recovered from this sum signal and used as system clock.

ISDN clock

In this case, clock recovery takes place using the receive clock of the ISDN interface (S0 or Uko).

SDH clock T0

For synchronization purposes, the SDH clock made available by the SDH expansion can also be used. See Section 3.6, *Clock Supply* .

2.3.2 Assignment of clock priorities

During configuration, each clock source available in an XMP1 network can be assigned a clock priority. This clock priority assignment takes place using the clock priority list. A node can have many clock sources which can be assigned a clock priority.

These clock sources can be the following:

- internal clock,
- external T3in clock,
- recovered receive clocks of the ports (maximally 16) and ISDN clock.
- SDH clock

If the operator does not assign a priority to all internal clock sources, these will be assigned a clock priority by the system. These priorities will be counted down from 65534.
All other clock sources without any priority will be automatically assigned priority 65535 by the system.

Up to 65534 clock priorities can be allocated in a PCM network.

2.3.3 Clock priority control

To control clock priorities, the number of the highest clock priority of the PCM network is sent out.
The clock priority is transmitted in bit Y5 of the service digits.

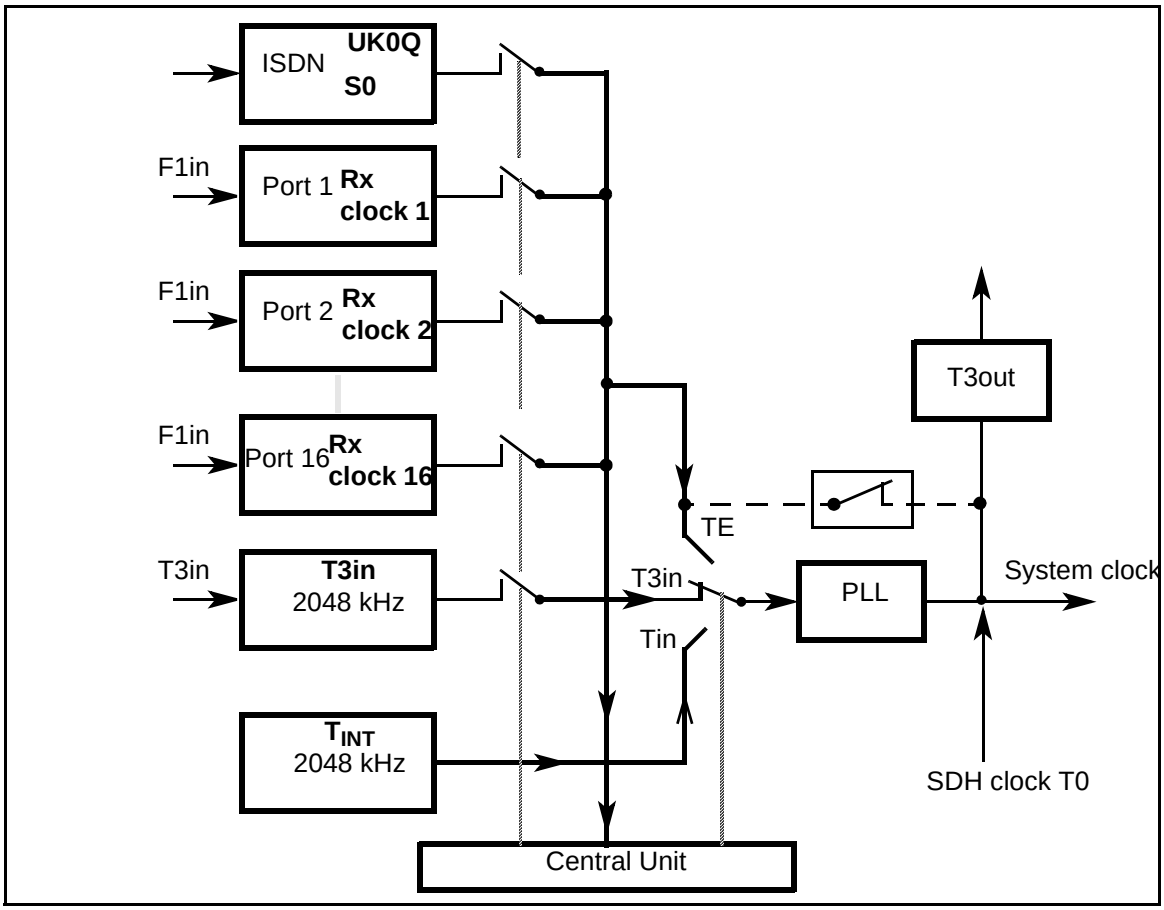
Each network node continuously polls the Y5 bits of the frame alignment signal of its ports and verifies as to whether it receives at one of its ports a clock priority higher than its own highest clock priority.
In this case, it sends out the clock priority received at all ports in the downward direction.
If the node has a higher priority than the one received, it sends out its own highest priority at all ports and assumes thus clock control of the PCM network. The clock priority thus accompanies the clock all the way through the network.

In case of an interruption of individual connections, the clock source with the highest priority will be used in the entire network still addressable. If - due to an interruption - the network is split up into individual isolated sub-networks, the clock source with the highest priority will be used within the latter.

The prerequisite for this clock control via the clock priority is that the connection between two network nodes is clock-transparent. If clock transparency is not ensured for this connection or for only one direction, clock priority evaluation must be suppressed at both or at one of the ports. The clock priority at an XMP1 port must thus be suppressed whenever a port receives a clock different from that injected into the far-end XMP1 port.

This evaluation of the clock priority at F1in of a port can be suppressed. This is possible via info no. 10 of the decentral card slot data of the port modules. If this info is set to "1", the Y5 bit available at this port is no longer evaluated as described above. Also see Section 2.3.6.8, *Suppressing the clock priority (at F1in)* .

Figure 2.6: Clock distribution


ISDN
UK0Q
S0
F1in
Port 1
Rx
clock 1
F1in
Port 2
Rx
clock 2
F1in
Port 16
Rx
clock 16
T3in
T3in
2048 kHz
T_INT
2048 kHz
T3out
TE
T3in
Tin
PLL
System clock
SDH clock T0
Central Unit

2.3.4 Clock switchover

The internal clock of a node run at a reference clock such as the T3in clock or the Rx clock of a port is digitally detuned to the frequency of this reference clock. In doing this, a resolution of ±1/8 Hz is achieved.

If the reference clock fails, the node switches over to the detuned internal node clock.

After switchover, the detuning of the internal clock is eliminated in individual steps until it runs again using its own frequency and precision.

2.3.5 Clock control for co-channel radio operation

For transmitting co-channel radio signals or ripple control signals, a constant delay time is required for the corresponding channels.

For this purpose, the delays in the elastic memories of the ports must be kept constant. This is achieved by linking the transmit frame of the network node phase-rigidly to the receive frame of the ports to be used for transmitting co-channel radio signals.

In a network node, not only the frequency but also the phase position of the transmit frame to the port providing the clock is controlled in such a way that even after signal interruptions or voltage failures, the initial phase relation is restored. Thus, the required constant delay time is achieved due to the constant phase relation.

With a stable network status, the phase positions of all ports concerned are measured in relation to the transmit frame and stored in the node. If in case of later network failures, the clock is recovered from another port, the initial phase relation can nevertheless be restored.

Note:

In the initial version (prior to 1995), only one clock tree to be permanently configured by the user was possible in phase rigid operation (clock priority 0).

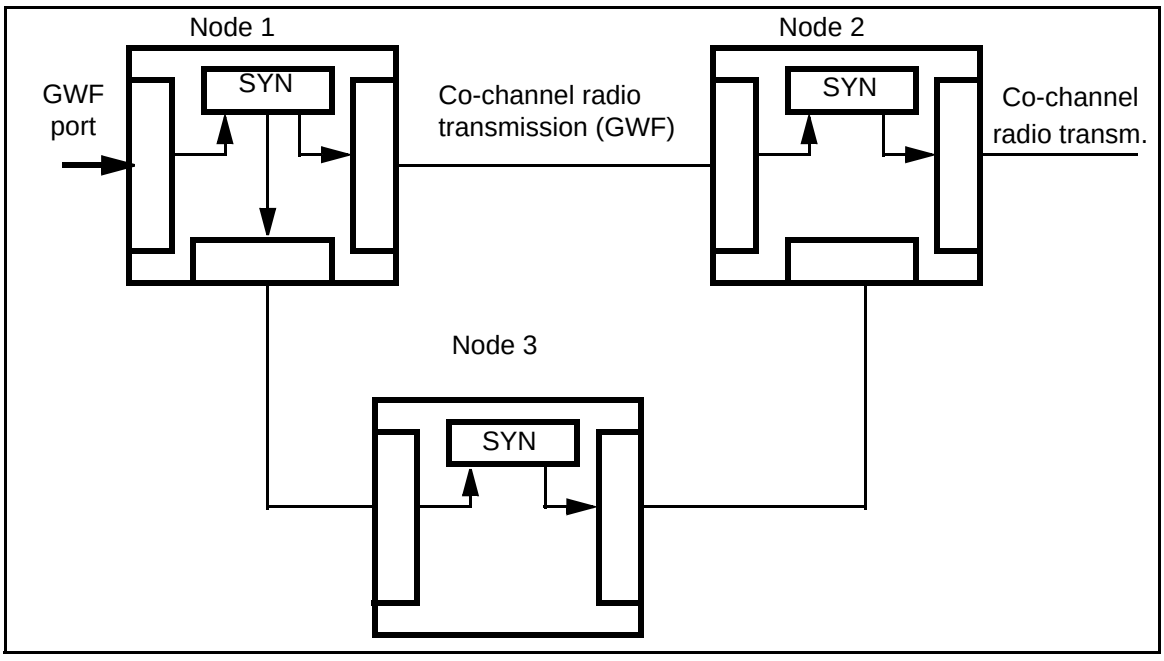


Figure 2.7: Clock control in co-channel radio transmission

2.3.6 Clock configuration in the XMP1 network

Settings regarding the configuration of clock control in the XMP1 network are performed via the clock priority list and central or decentral card slot data of the modules.

Clock control settings via the central or decentral card slot data are executed for the Central Units and port modules.

2.3.6.1 Central Units

Central card slot data

The following table gives an overview of the info nos. of the central card slot data that can be used for clock control.

Tab. 2.G: Central card slot information - Central units

Info no.	Description		Default value
2	Prefer local clock sources	yes = 1	0
3	Reserve priority 2 for preferred clock tree	yes = 1	0
4	Node phase-rigid w/o co-ch. radio port	yes = 1	0
5	Switch off T3out when port is faulty	yes = 1	0
6	Recover T3out from Rx clock	yes = 1	0
9	Operation with preferred clock priorities	yes = 1	0
10	Wander filter	yes = 1	0

2.3.6.2 Port modules

Decentral card slot data

With port modules, the settings for clock control are performed using the info nos. of the decentral card slot data.

These info nos. are listed in the following table.

Tab. 2.H: Decentral card slot data - Port modules

Info no.	Description		Default value
10	Suppress clock priority (F1in)	yes = 1	0
12	Preferred port for priority 1	yes = 1	0
14	Short delay time in linear networks	yes = 1	0

2.3.6.3 Preferring local clock sources

A network node can have clock sources distinguishing themselves by their high precision and reliability. However, it is possible that these clock sources are nevertheless not used for clock recovery in the network, because they have been assigned such a low priority that they are never used for clock recovery.

In order to use such clock sources for clock recovery in the local node, the latter can be configured via the central card slot data (info no. 2) in such a way that the local clock sources (T3in or ports with configured clock priority) of this node are preferred.

With this configuration, the node then uses the configured local clocks according to their clock priority. The clock priority received at the ports in bit Y5 is not evaluated.
Only if these local clock sources have failed, clock priorities possibly received at other ports in the service digits are used for clock control.
For this purpose, info no. 2 must be set to "1" in the central card slot data of the Central Unit.

2.3.6.4 Wander filter

If several HDSL links are switched in series, the low-frequency jitter (wander)) caused by the HDSL units can be reduced by setting info no. 10 to "1". The wander reduction, however, leads to an increased phase noise, i.e. high-frequency jitter, which is filtered out again in the next node.

2.3.6.5 Using T3out

For the clock supply of external units, the Central Unit provides a clock interface T3out. This T3out clock is distributed via the X6 connector of the Central Unit. With the default setting, the system clock of the node is provided under all operating conditions.

In case of failures, e.g. BER 10-3, loss of sync etc. at the port from which the receive clock is recovered, the T3out clock can be switched off.

For this purpose, the following settings are possible in the Central Unit (central card slot data) of the node:

Info no. 6:
Recover T3out from receive clock.

Info no. 5:
Switch off T3out in case of a port failure.

2.3.6.6 Delay time reduction in linear networks

In linear networks, the delay time of the port can be reduced by about 60 µs compared with the statistical average value.

This setting is made in the decentral card slot data of the ports using info no. 14 "Short delay time in a linear network".

However, this function is also possible on line sections in meshed networks or star networks. With short delay times adjusted, line breaks or clock source switchovers will first lead to an increased number of frame slips before the most favorable phase position for short delay times is achieved. For this reason, this delay time reduction option should be enabled only if required.

In nodes where lines from at least three directions are received and meshes are therefore formed, this function is not recommended. In this case, the network becomes relatively sensitive to jitter and clock switchovers and an increased number of frame slips have to be expected.

This function should be activated only in conjunction with the following Central Units.

Tab. 2.I: Central Units for delay time reduction

Central Unit CC/QD2	62.7040.310.00-A001	AN00102460
Central Unit CC	62.7040.320.00-A001	AN00102461
Central Unit GN	62.7040.330.00-A001	AN00102462
Central Unit GN/QD2	62.7040.355.00-A001	AN00239607

The Central Units offer a hardware considerably improved for this function.

On all other Central Units, processes are much more complex so that the use of the described function is not recommended.

2.3.6.7 Configuring a clock tree with preferred priority

Preferred port for priority 1

To switch off the automatic clock tree assignment function, it is possible to define a preferred port in XMP1 nodes.
In order to ensure that a fixed path is observed for setting up the clock tree in a fully operational network, any port can be selected and configured as preferred port for priority 1.

In this case, only Y5-bit evaluation at the preferred port is used in this node for clock control. The Y5-bits of all other ports in the node are no longer taken into consideration.

In the root node of the clock tree, clock priority 1 is therefore selected from the clock priority list to achieve a secure clock such as the T3in clock.

In all other nodes of the clock tree, the ports used as preferred ports for clock priority 1 are configured via info no. 12 of the decentral card slot data.

Simultaneously, clock priority 2 must be reserved. When making the configuration using SOX, clock priority 2 is simply not assigned in the entire network. See Fig. 2.8.

In the example shown below, node 1 is the clock master with priority 1 for T3in. The Tint clock in node 3 is assigned clock priority 2.

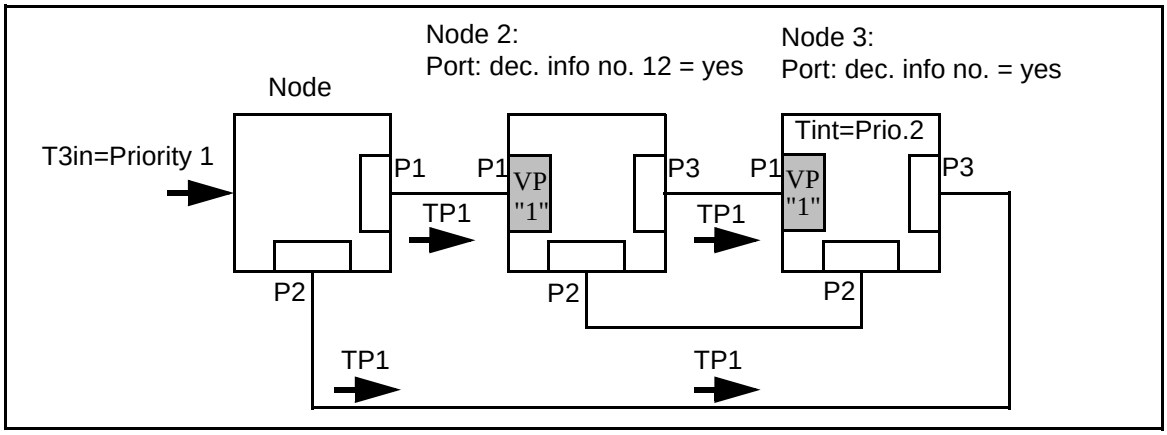


Figure 2.8: Clock transmission with preferred clock priority 1: normal operation

Loss of signal at a preferred port

If the 2 Mbit/s signal fails at the preferred port 1 of node 2, the Y5-bit available at port P3 will be evaluated in node 3. Since clock priority 1 is also being received at this port, clock priority 1 is still valid for node 3. Since, however, clock priority 1 is now evaluated at a port not defined as preferred port, not clock priority 1 is passed on, but the reserved clock priority 2 is injected. This indicates that the clock is currently not spreaded in the defined preferred clock tree. See Fig. 2.9.

Note: If clock priority 1 was still passed on by node 3, it could arrive at port P1 in node 3 via node 2. This would lead to a clock loop and clock recovery in node 3 would continuously switch over between port P1 and P3.

However, node 2 now receives clock priority 2 at ports P2 and P3. Since this clock priority is higher than a clock priority possibly adjusted in node 2 (clock priority 2 has been reserved), the clock is recovered from one of the ports P2 or P3.
Node 2 now also sends out clock priority 2 in the downstream direction. In node 3, clock priority 2 is now being received at preferred port P1. However, since node 3 receives clock priority 1 at port P3, the clock is continued to be recovered from port P3. The formation of a clock loop is thus prevented.

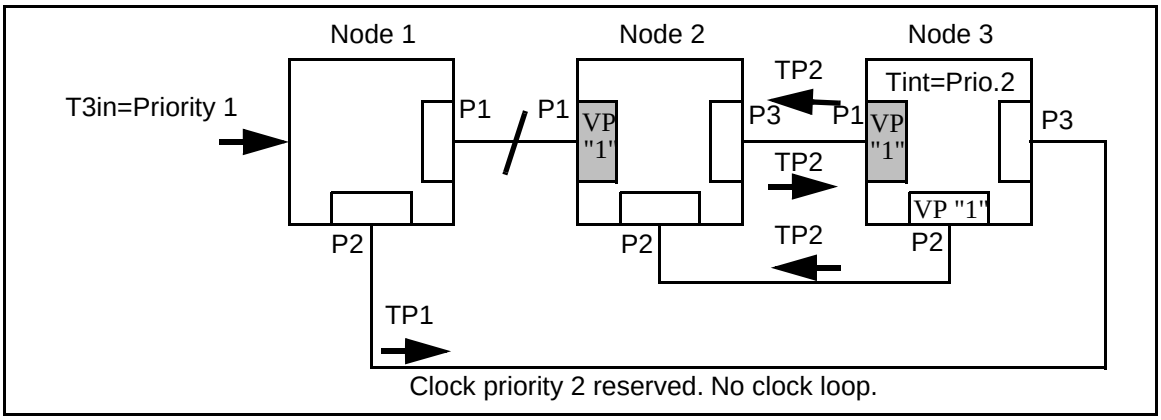


Figure 2.9: Clock transmission with preferred clock priority 1: Signal loss at port 1 in node 2

Priority 1 clock failure

If the priority 1 clock fails in node 1, clock control in the network is performed with the clock priority ≥ 3 assigned in the clock priority list, since clock priority 2 has been reserved.

2.3.6.8 Suppressing the clock priority (at F1in)

Using info no. 10 it is possible to suppress the evaluation of the clock priority at F1in of the port interface.

Info no. 10 = 0:
The clock priority is evaluated at F1in of the port interface (default setting).

Info no. 10 = 1:
The clock priority is not evaluated at F1in of the port interface.

Example 1

The following example shows an application with the clock priority being suppressed at F1in.

In this example, transmission between the two XMP1 nodes takes place via a third-party unit (e.g. PCM FXE). The system channel is re-routed via channel 29.
Thus, the clock priority is also transmitted in channel 29.
Thus, for passing the third-party unit, info no. 10 must be set to "1" for the port from which the third-party unit recovers the clock.
In case of a drop including a PCM30 FXE unit, this is normally port 1.

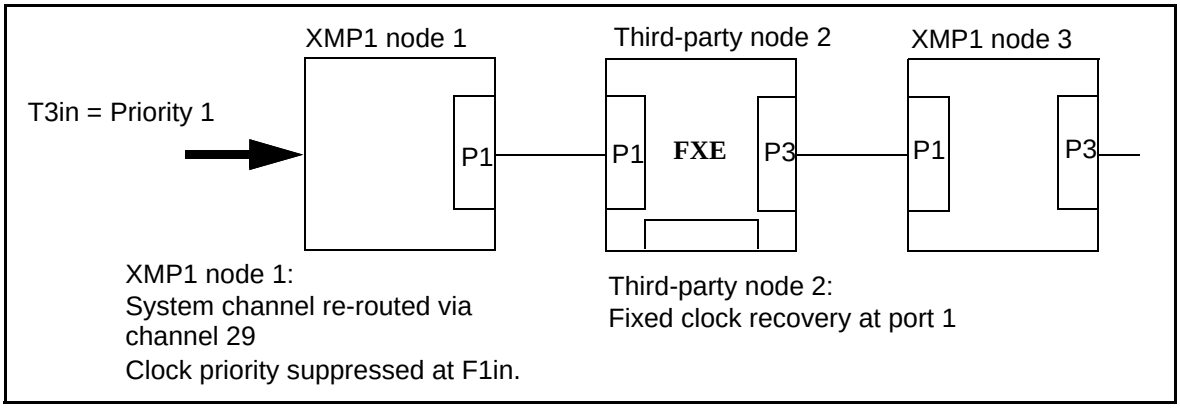
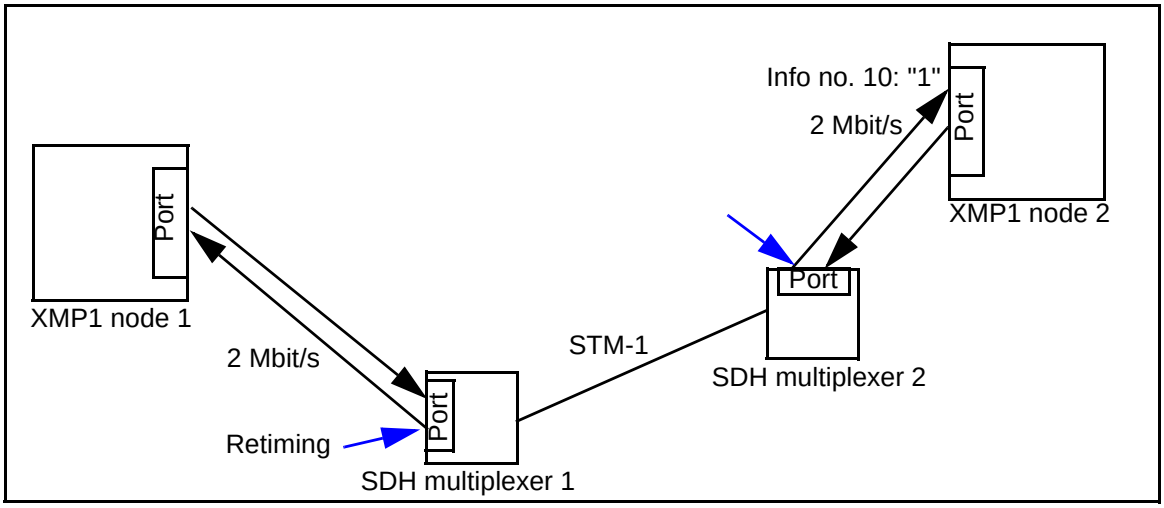


Figure 2.10: Suppressing the clock priority (at F1in)

Example 2:

In the following example, transmission between XMP1 nodes 1 and 2 takes place via two SDH multiplexers. In these multiplexers, a retiming process is performed for the 2 Mbit/s signal. Thus, XMP1 node 2 receives a clock different from the one supplied by XMP1 node 1. This also applies to XMP1 node 1. For this reason, the clock priority at F1in must be suppressed at the port of XMP1 node 1 and 2 using info no. 10.



2.3.6.9 Regionalization of clock synchronization

In order to enable a preferred clock connection of nodes to nearby clock sources, a list of clock priority nos. can be defined for each node. In this case, the node uses the clock priorities contained in the list for clock control, irrespective of the highest clock priority identified by the node.

Central card slot info no. 9 of the Central Unit in the corresponding node must be set to "Operation with preferred clock priorities".

In order to ensure a high flexibility, up to three stages can be configured. These stages are defined in lists (list 1, 2 and 3), list 1 having the highest priority.

By entering a list in a node, all lower-priority lists existing in this node will be deleted. On entry of a "pseudo-list 0", all lists available in the node will be deleted.

Example:
On entry of a list 1 in the node, all lists 2 and 3 already existing in the corresponding node will be deleted. These lists must then be re-entered, if required.

The nodes first use the clock priorities configured by means of list 1.

Only if a clock priority is not found in list 1, the clock priorities contained in list 2 are taken into consideration.
If in the list configured last, a clock priority is not found, the normal clock priority control function of the XMP1 network is used.

The clock priority list is entered via "Online Functions -> Debugging“ using Debugging commands and sent out to the node.

Debugging commands can also be used to request these lists.
To change any settings in the node, the write function must be enabled using the debugging command "#>enable <password> <timet>".

Fig. 2.11 shows a network with regional clock priorities and two stages (list 1 and list 2) configured.

List 1 specifies that clock priorities 10 and 5 are to be preferred as local clock priorities by nodes 1 to 10 (sub-network 1).

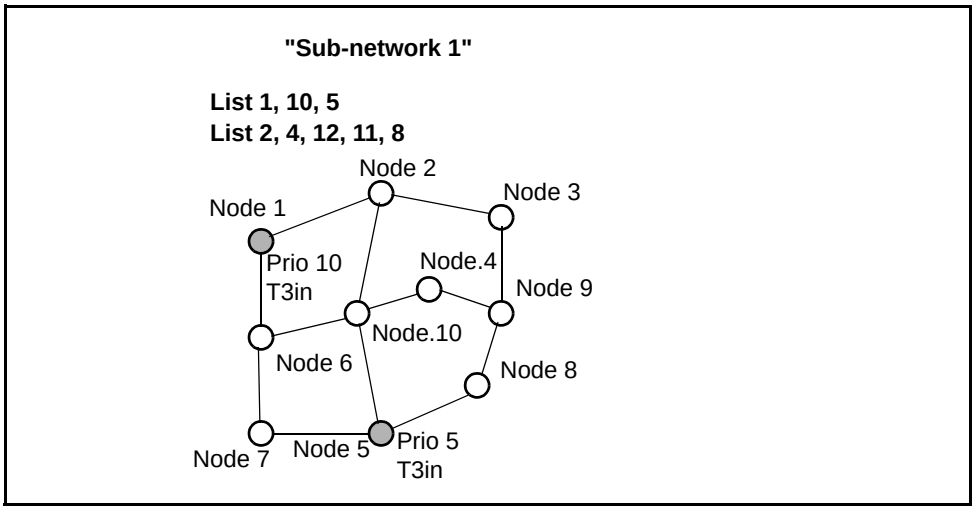


Figure 2.11: Example

List 1 containing the clock priorities 10 and 5 is sent to nodes 1 to 10 by means of the debugging command (set_vz_tp 1, 10, 5).

For nodes 1 to 10, the central card slot information no. 9 of the Central Units must be additionally set to "Operation with preferred clock priorities".

These settings ensure that nodes 1 to 10 use the local clock priorities defined in list 1 for clock control.

In this way, the entire network is divided up into sub-networks by defining stage-1 lists (list 1) regarding clock priority control.

The 2nd stage (list 2) for nodes 1 to 10 includes the clock priorities (4, 12, 11 and 8) of list 1 of the neighbouring sub-networks 2 and 4.

This list 2 is also sent to nodes 1 to 10 by means of debugging command (set_vz_tp 2, 4, 12, 11, 8).

For sub-networks 2 to 6, the lists are defined accordingly and sent to the nodes.

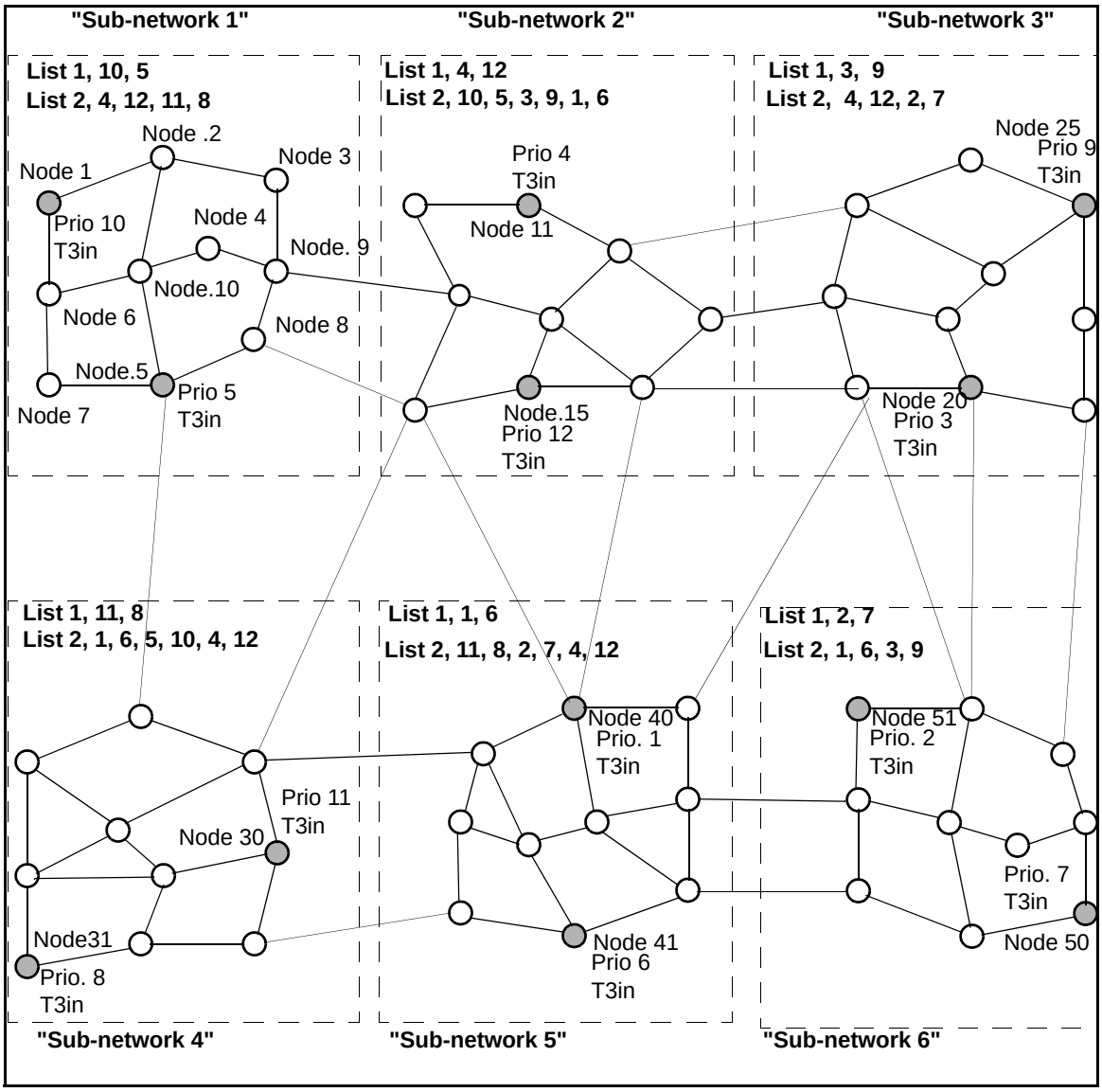


Figure 2.12: Regional clock priorities

2.4 2 Mbit/s Connections

The structure of a PCM network is defined by the nodes and the 2 Mbit/s connections between the individual nodes. Each node available in the network is assigned a hardware number. This hardware number permits the node to be addressed within the network. The 2 Mbit/s connections are switched between two ports.

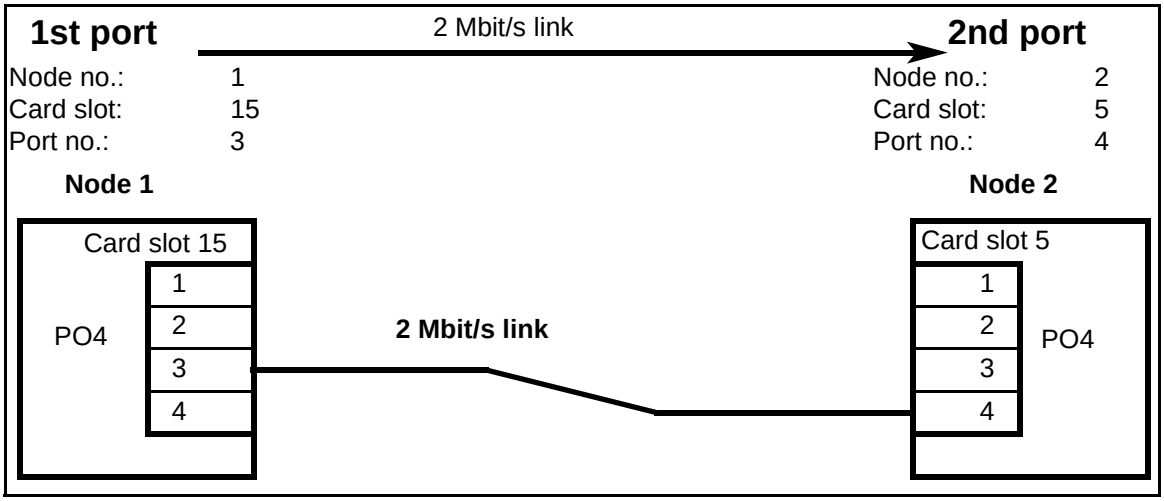


Figure 2.13: Node links

2.4.1 Setting options for the 2 Mbit/s connection

Signalling channel in time slot 16

If a 2 Mbit/s connection is used to transmit voice signals, time slot 16 of the pulse frame must be defined as signalling channel.
If only data are transmitted, time slot 16 can be used as additional data channel 31.

CRC4 procedure

In addition to the frame synchronization process, the CRC4 procedure can be applied to ensure frame synchronization. Also see Section 2.2.2, *CRC4 procedure* .

Processing service digits

The system channel is composed of the signal used to control clock priority and the signal used for communication between the nodes and network management system, i.e. the ECC8. In normal cases of application, the system channel is transmitted in the Sa bits carried in time slot TS0 of the PCM30 frame.

— The signal used to control the clock priority in the XMP1 network is transmitted in the Sa5 bit of the system channel.

— The ECC8 is transmitted in the Sa7 and Sa8 bits of the system channel.

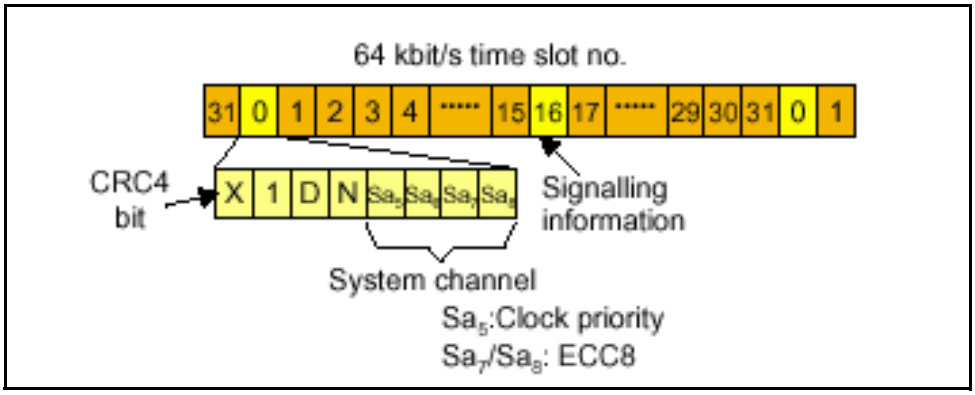
The utilization of the ECC8 channel and signal for controlling the clock priority can be set independently of each other.

System channel transmission can be re-routed from time slot TS0 to time slot TS30.

Basically, the user can define as to whether the system channel shall be used or not.

If the system channel is not transmitted in time slot TS0 or if it is not used at all, traffic data can be transmitted in bits Sa5 to Sa8 carried in time slot TS0.

The following diagram shows the structure of TS0 in the PCM30 frame.


64 kbit/s time slot no.
31 0 1 2 3 4 ..... 15 16 17 ..... 29 30 31 0 1
CRC4 bit
X 1 D N Sa8 Sa7 Sa6 Sa5
Signalling information
System channel
Sa5:Clock priority
Sa7/Sa8: ECC8

Rerouting the system channel (Bit Sa5 ...Sa8)

The system channel transmitted in time slot 0 can be rerouted via time slot 30 (channel 29). Thus, the Sa bits in TS0 can be made available for transmitting a third-party system channel.

If the system channel shall be routed via a third-party node, it must also be rerouted via time slot 30 (channel 29). In the third-party node, you must ensure that time slot 30 (channel 29) is through-connected for system channel transmission.

No system channel transmission

The transmission of the system channel in time slot 0 can be switched off. This is required - for example - for ports to a third-party system if there is no further downstream XMP1 node.

In this case, bits Sa5. . . Sa8 of time slot 0 can be used to transmit traffic data. This option is used - for example - for a nx64k connection with the Port nx64 module. With n=31, the signalling information must be transmitted in bits Sa5. .Sa8 of TS0.

The designations previously used for signalling information are no longer used in the SOX software.

The following table shows the assignment of service digits to functions:

Tab. 2.J: Service digits

SERVICE DIGITS	SYSTEM CHANNEL IS USED	SIGNAL FOR CONTROLLING CLOCK PRIORITY IS TRANSMITTED	ECC8 IS TRANSMITTED IN SYSTEM CHANNEL	PAYLOAD IS TRANSMITTED IN BITS SA5...SA8 OF THE OUTGOING SERVICE DIGITS	NOTE
M_0	yes	yes	yes	no	
M_1	yes	yes	yes	yes *	
M_2	yes	no	yes	no	3.85 and higher
M_3	yes	yes	no	no	3.85 and higher
M_4	no	no	no	no	
M_5	no	no	no	yes	
M_6	yes	no	yes	yes *	3.85 and higher
M_7	yes	yes	no	yes *	3.85 and higher
* System channel transmitted in TS30.					

Protection switching configurations

The configuration of node links also includes protection switching options. The following protection switching processes can be defined:

- Line protection switching (port protection switching)
- Card protection switching

See also Section 2.7, *Protection Switching Configurations* .

2.5 Circuit Connections

The 64 kbit/s channel links must be defined within a node.

The following operating modes are possible:

- Standard
- Polling
- Ring polling
- Multi-polling
- Channel protection switching

In the following description, the terms "converter address" and "port address" are used.

These terms can be briefly described as follows:

The **converter address** is defined by the card slot no. of the module and the converter no. on the module.

12/2 means:
Module in card slot 12 of the XMP1 subrack and converter no. 2 on the module.

The **port address** is defined by the card slot, port no. on the module and PCM channel no..

14/2/10 means:
Port module in card slot 14, port interface 2 on the module and channel no. 10 of the PCM frame.

2.5.1 Standard operation

In this operating mode, the 64 kbit/s channel and signalling information contained in time slot 16 of a port interface are assigned to a converter.

The diagram depicted below shows an example of standard operation.

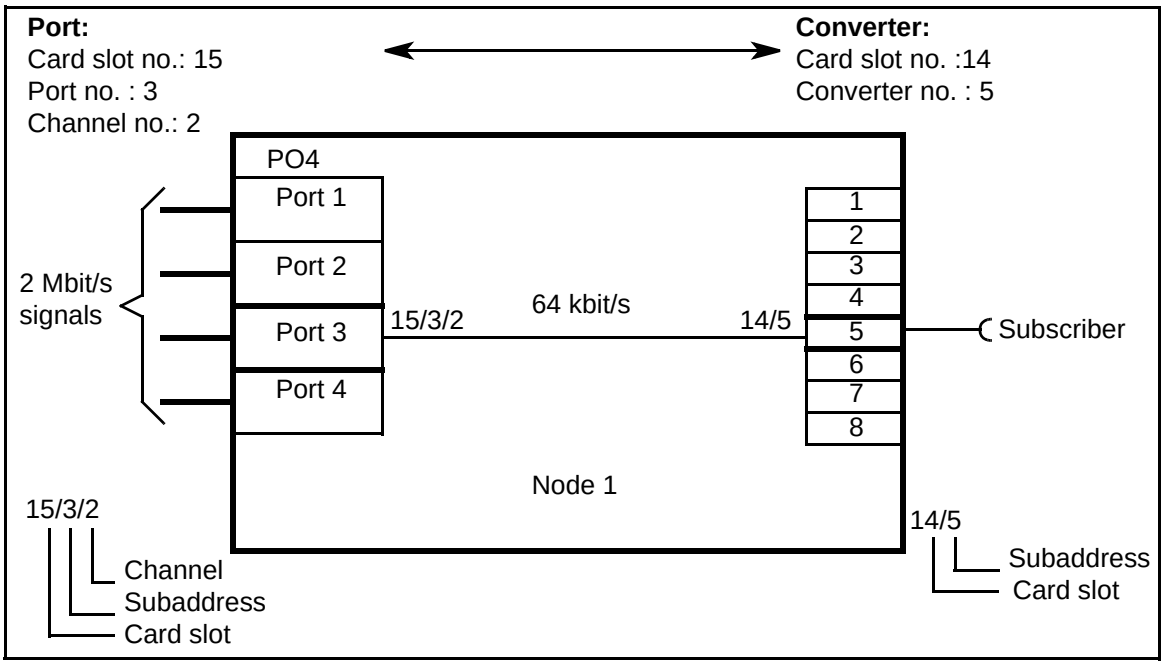


Figure 2.14: Standard operation, Port <-> converter

In the conversion mode, a channel link is switched between two converters located in the same node.

The 64 kbit/s signal of converter a is transmitted directly to converter b.

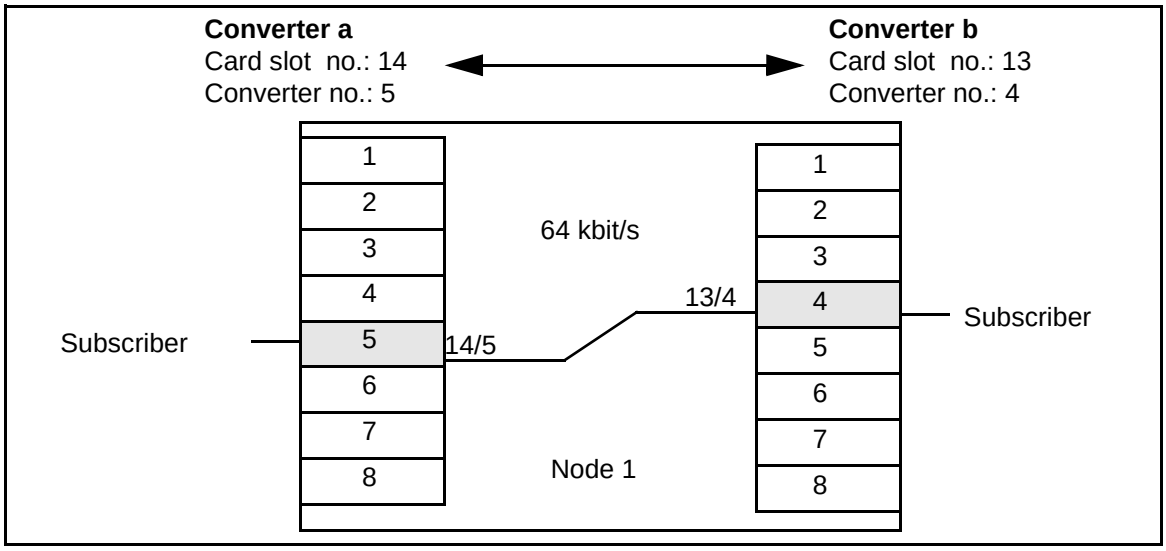


Figure 2.15: Conversion mode, converter <-> converter

Routing ISDN channels in the standard operating mode

64 kbit/s channels for ISDN interfaces are routed in the standard operating mode. On the ISDN module, the distribution of the 64 kbit/s channels to the eight converters is implemented by 16 variants which can be adjusted via the central card slot data of the ISDN module.

2.5.2 Polling

The polling mode permits data transmission between a master station (polling master) and several sub-stations. Each sub-station monitors the data transmitted by the polling master (listening). In consequence of a "request to send" received from the polling master, each sub-station can communicate with the latter.
Connections between sub-stations are not possible.

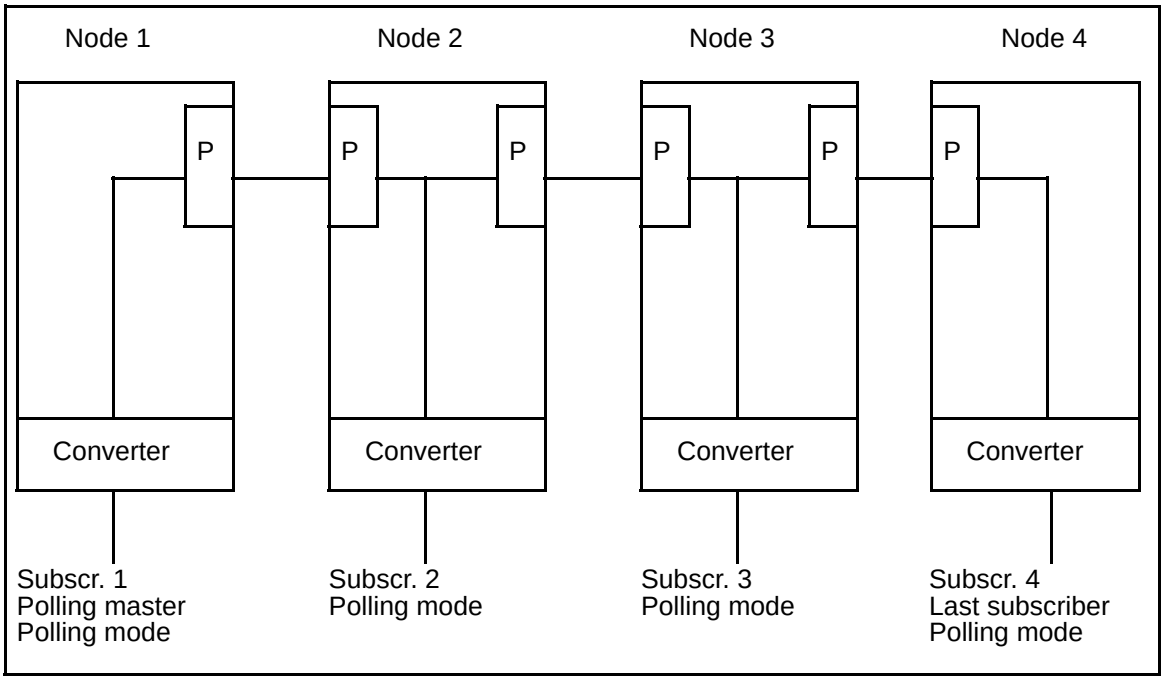


Figure 2.16: Polling configuration

The operating mode of the polling master and last sub-station corresponds to the standard mode, i.e. a channel link is switched between a port and a converter.

In the last converter of the polling link, info no. 10 "Block VF in case of incoming b-bit" must be set in the decentral card slot data of the converter.

> **Note:** The KZU FEK module supports the polling operation in the not extended configuration.

In the sub-stations, port a, port b and the converter are connected via a channel link.

Setting up a connection between the polling master and a subscriber

1. In the quiescent state, all converters are involved in a port-to-port connection.
2. The master station wishes the setup of a connection to a sub-station and goes off-hook. The a-bit is sent out.
3. All sub-stations now receive the incoming a-bit.

4. The master station sends out the subscriber ID.
5. The calling sub-station detects this ID and answers (off-hook).
   The called sub-station sends an outgoing a-bit.
6. The master station receives the a-bit from the called sub-station and sends the outgoing b-bit.
7. All sub-stations receive the b-bit.
8. There is a connection between the called sub-station and the master station.
   For all other sub-stations, the link is occupied.

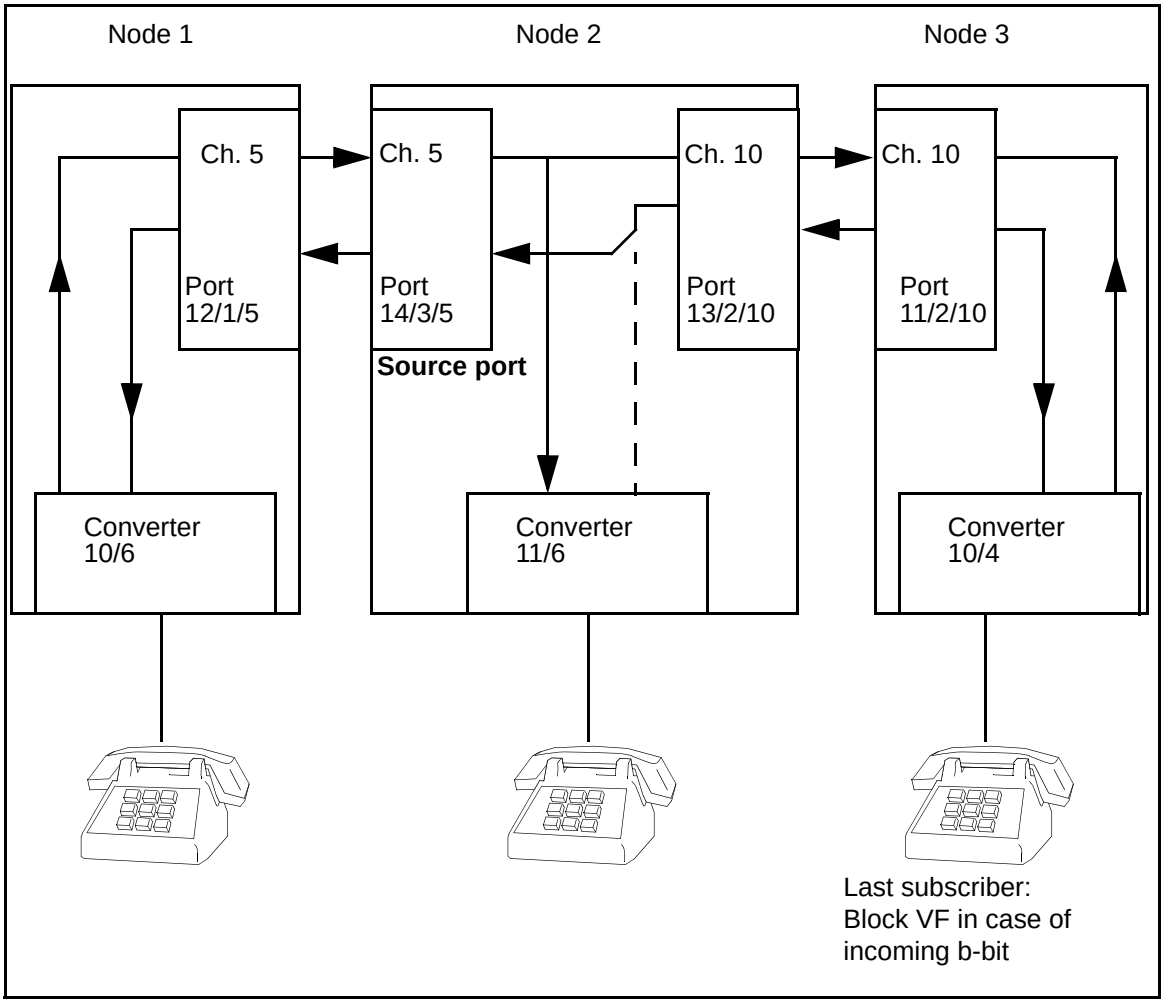


Figure 2.17: Polling operation

2.5.3 Ring polling

The ring polling mode permits data transmission between subscribers connected to form a ring. In the ring polling mode, all subscribers are equal in priority, i.e. there is no master station.

Data transmission takes place in a ring into both directions. Thus, transmission is ensured even if one direction is cut.

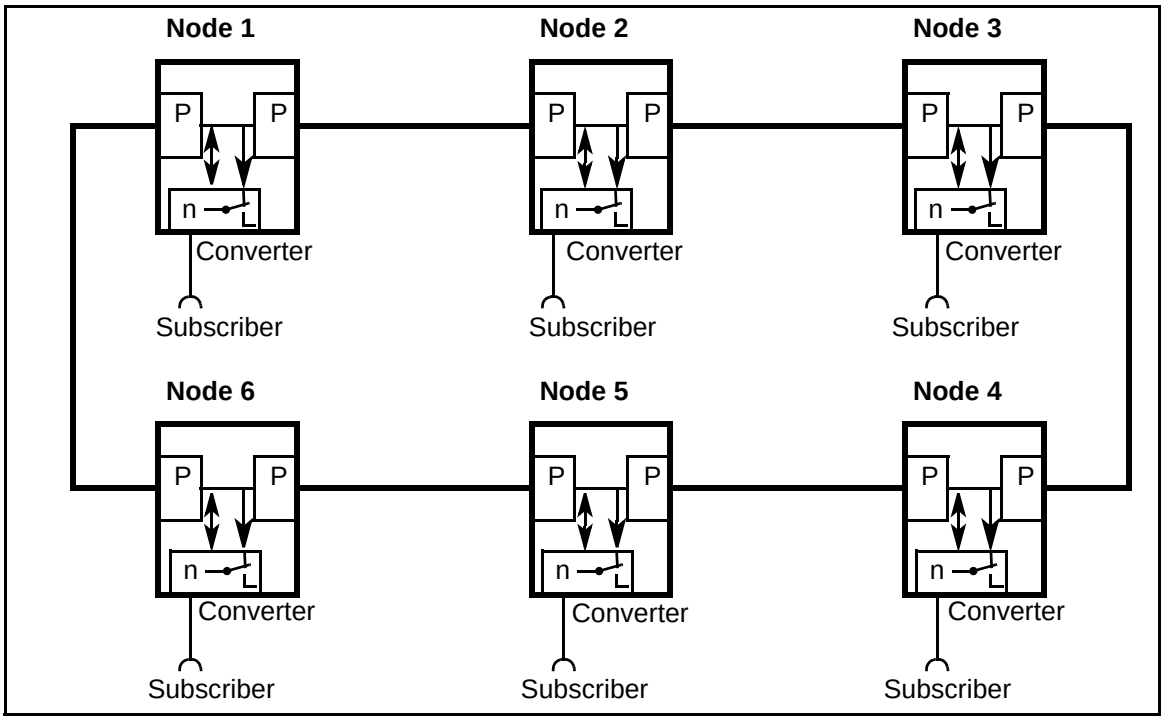


Figure 2.18: Ring polling configuration

The subscriber is connected to converter n.
In the "Routing" section, "Ring polling" option must be selected.

In normal operation, i.e. as long as there is no polling requst, all converters operate in the "Standard" mode. In this case, converter n is connected to port a and port b.

Setting up a ring polling connection

1. Subscriber 1 wishes to set up a connection to subscriber 2.
2. All converters are in standard operation (converter - port).
3. Subscriber 1 goes off-hook and transmits bit a in both directions of the ring.
4. Subscriber x and subscriber 2 receive bit a and set up a port-to-port connection.
5. The identification of the subscriber to be called is sent out in the ring.
6. Subscriber 2 detects his identification and goes off-hook.
7. Subscriber 2 identifies the a-bit received and his own busy state, switches to standard operation and transmits his bit b in both directions of the ring.
8. Subscriber 1 identifies the b-bit. The connection between subscriber 1 and subscriber 2 is set up.
9. All other ring subscribers are now being blocked. Listening to the 64 kbit/s information is no longer possible.

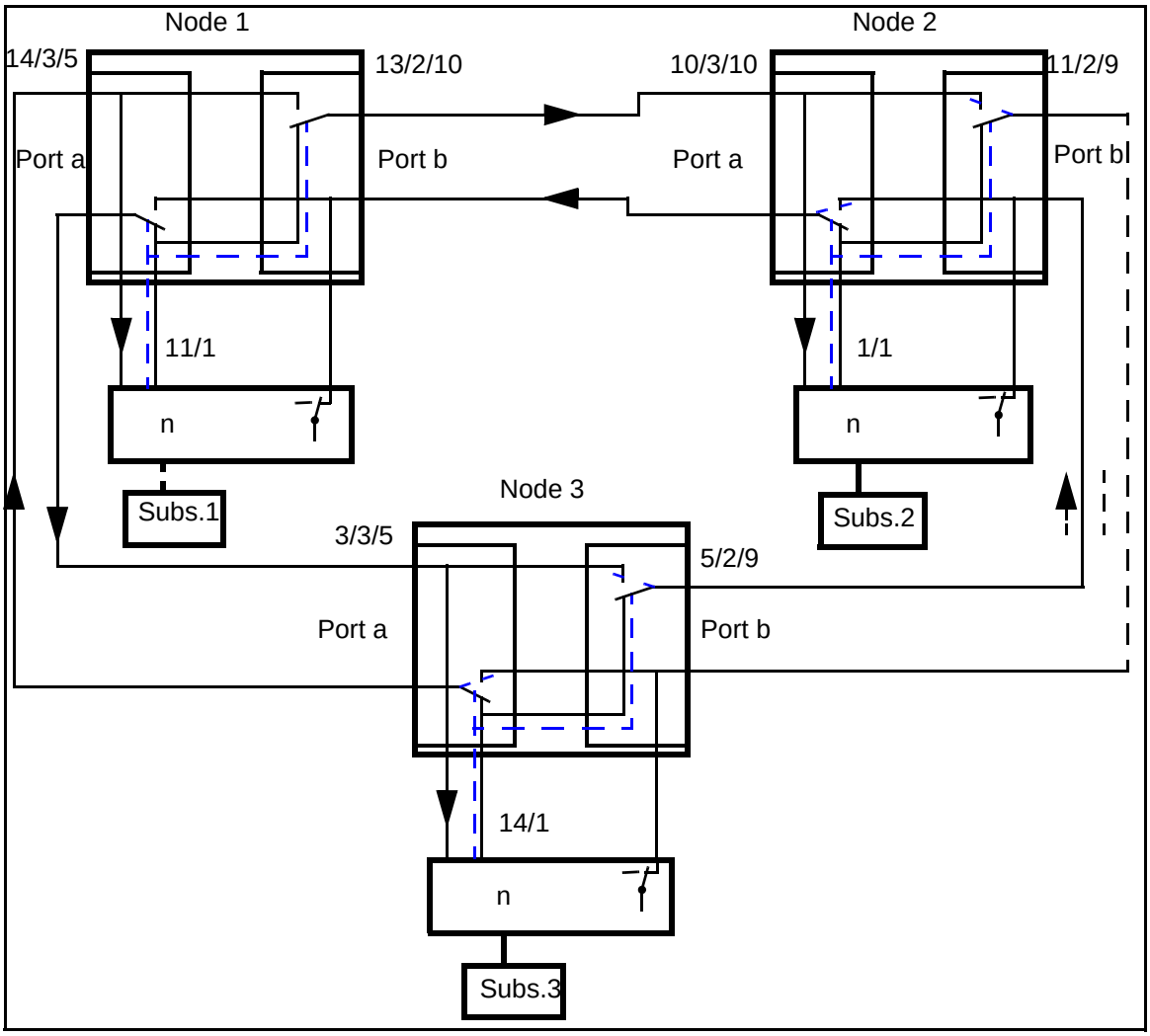


Figure 2.19: Ring polling operation

2.5.4 Multipolling

In multipolling operation, which represents a special polling option, several converters located on one module can be involved in the polling function. The master station can request the sub-stations involved in multipolling to send their data. Only one sub-station can transmit data to the master station at a time.

If several converters of the same module shall participate in multipolling, the total number of converters concerned must be indicated. The converters following the one entered as first multipolling converter are defined as further multipolling converters (sub-stations).

In the last converter of the polling link, info no. 10 "Block VF in case of incoming b-bit" must be set in the decentral card slot data of the converter.

> **Note:** Multipolling is supported by analog KZU modules with drawing no. 62.7006.xxx.xx and 62.7026.xxx.xx.

Example: Converter 3 of the module accommodated in card slot 12 is the first multipolling converter.
Total number of multipolling converters: 3
Converters 3, 4 and 5 are thus defined as multipolling converters on the module accommodated in card slot 12.

The first multipolling converter on the module located at the beginning of the multipolling section, is defined as multipolling master automatically (master station). On this module, only one converter can be defined as multipolling converter.

Converters not participating in multipolling can be used as normal converters, polling converters or ring polling converters.

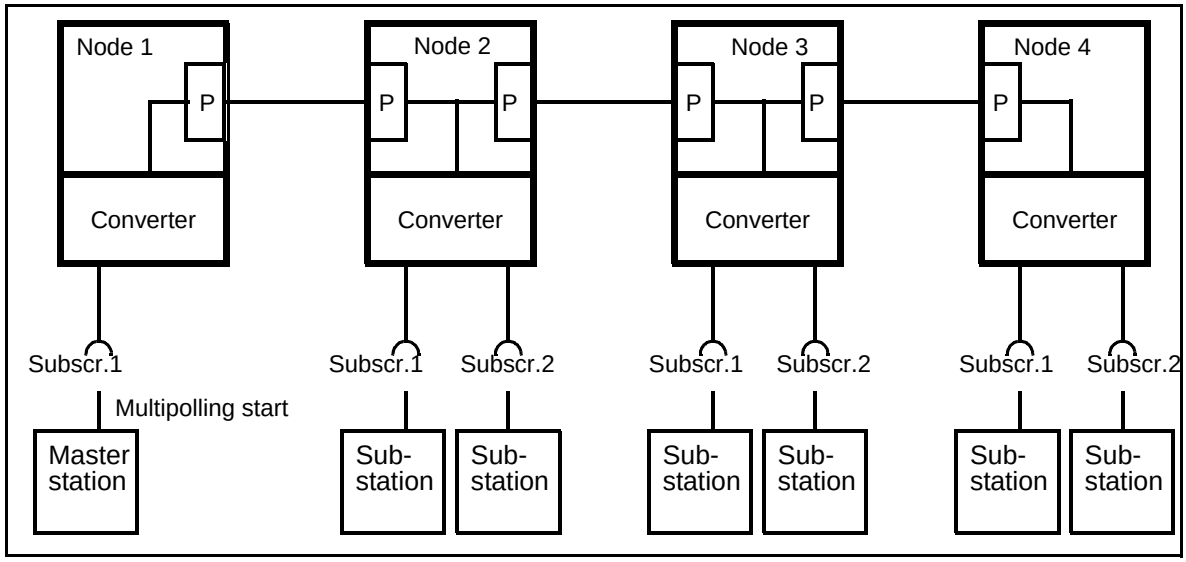


Figure 2.20: Multipolling configuration

Setting up a connection between the multipolling master and a subscriber

1. If the polling master wishes to communicate with a sub-station, it transmits a "request to send" in the 64 kbit/s data stream of the multipolling section.
2. All subscribers monitor these data.
3. The subscriber addressed by the multipolling master identifies the request to send and sets up a connection to the latter.
4. The multipolling master identifies the connection to the required subscriber.
5. The master station and subscriber are connected to each other.
6. The multipolling section is then occupied and blocked for all other subscribers.
7. The subscriber addressed can now transmit his data to the multipolling master.

In the following example, a total of six converters are involved in multipolling.

The end of the multipolling link is located in node 3, the master station in node 1. The master station is converter 11/1 in node 1.

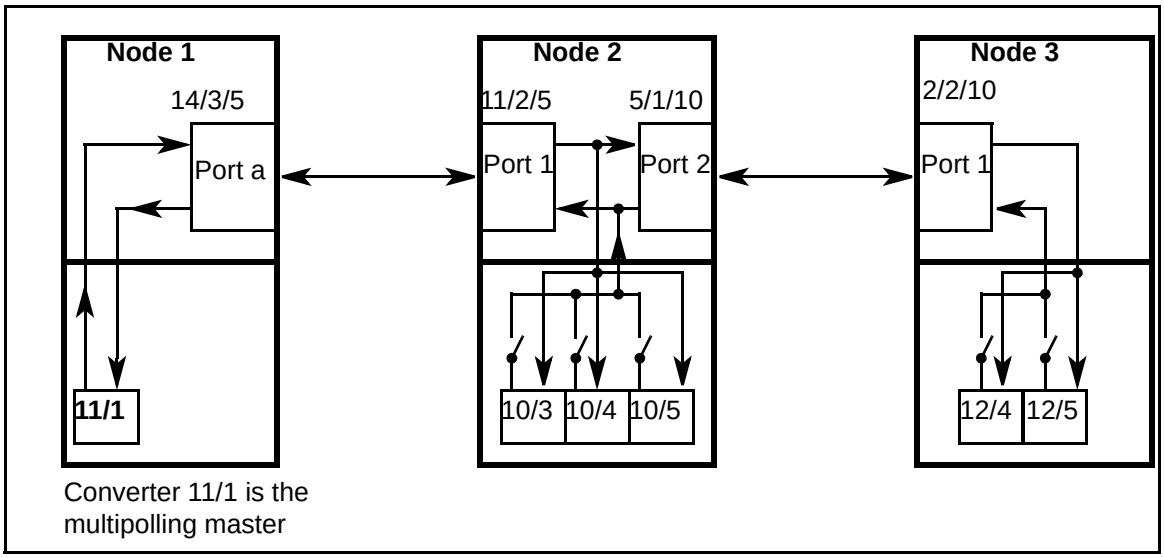


Figure 2.21: Multipolling configuration

2.5.5 Single-channel protection switching

Single-channel protection switching is a special ring polling function. This function permits a protection path to be switched for a converter.
Two channels that can be routed in the network via different paths must each be switched in the starting and end node to a converter.
Single-channel protection switching is possible for the KZU SUB, KZU EX, KZU FEK, DSK 64k, DSK V.24, DSK X.21, DSK V.35 and DSK WT modules.

In the transmit direction, converter n is involved in a channel link between port a and port b. In the receive direction, converter n is connected to port a and port b. The subscriber is connected to converter n. The protection path is switched via port b. "Protection switching" must be entered as operating mode in the "Circuits" mask.

> **Note:** In the central card slot information of the ports via which the channel path is routed with single-channel protection switching, info no. 2 "Interrupt signalling immediately in case of failure" must be set.

In the example depicted below, converter 11/1 is linked to port 14/3/5. Port 13/2/10 is defined as protection port.

Normal operation:
Port 14/3/5 and port 13/2/10 monitor the data transmitted by converter 11/1. Transmission is effected via link 1. The converter receives its information from port 14/3/5.

Protection link:
As soon as link 1 fails, AIS is transmitted in the service digits. Converter 11/1 identifies AIS and switches over immediately to the receive data of port 13/2/10 of the protection link. The receive data are applied to converter 11/5 and are passed on to the subscriber.

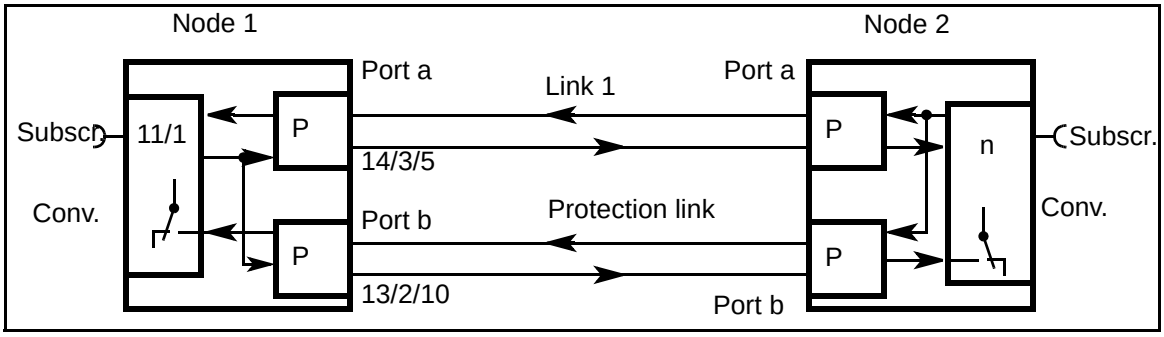


Figure 2.22: Single-channel protection switching

2.6 Conference Circuits

2.6.1 Digital conference for data channels

The channel modules permit a “digital conference” to be switched. In such a digital conference, several sub-stations (DTE) can be connected to one main station.

This main station can then exchange data with the sub-stations (DTE). The identification of the desired DTE takes place via the protocols exchanged between the main station and the DTE.

In the receive direction, each sub-station (DTE) receives the signal sent by the main station. In the transmit direction, the signals from the sub-stations are linked via an AND gate in the digital conference circuit and are then transmitted to the main station.

In the quiescent state, the signal is logic "1".

Each logic "0" is transmitted to the main station.

On one module, a maximum of 7 converter signals can be involved in a digital conference. This number is reduced by the number of interfaces connected.

Converters not participating in the digital conference can be used for other applications.

When a digital conference is switched, converter 1 is not available for other applications.

The alarms of converters n and converter 1 involved in the digital conference must be suppressed.

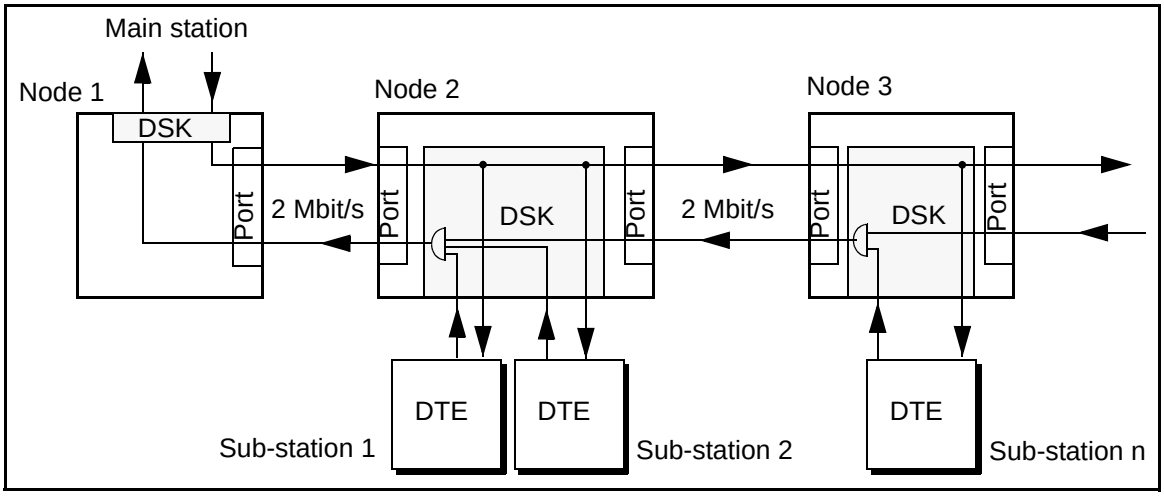


Figure 2.23: Block diagram of a digital conference

The following diagram shows an example of a digital conference.

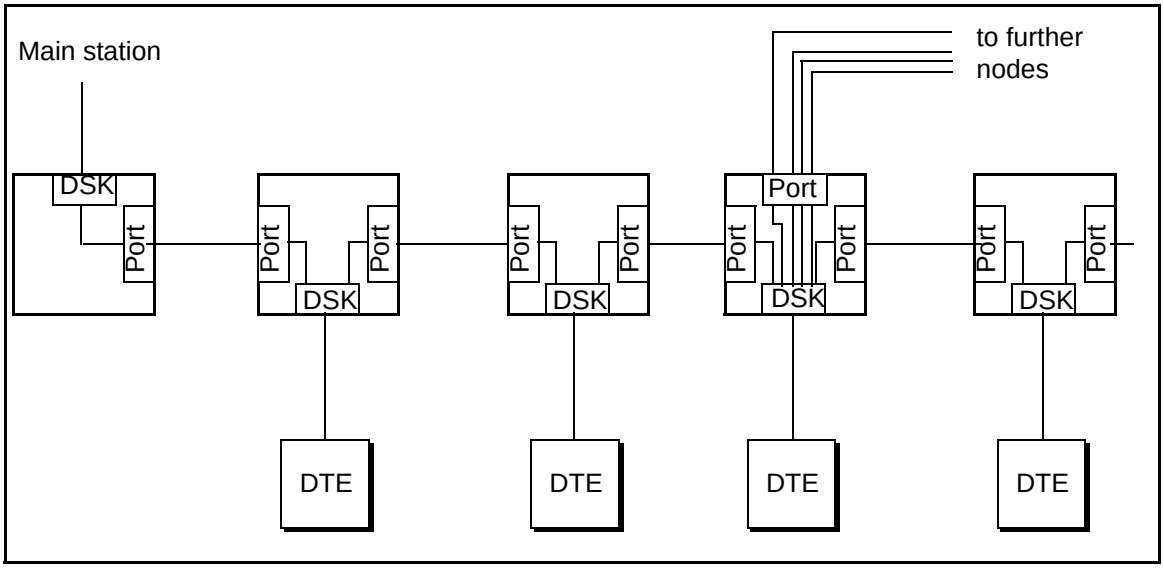


Figure 2.24: Digital conference

Configuring a digital conference

See Figure 4-26.

The DTE of sub-station 1 in node 2 must be connected to interface 5 of the DSK module.

Using the "STANDARD" function, converter 5 of this interface must be connected to another converter (converter 6 n the above example) of the module.
In the central card slot data of the module, this converter 6 must be defined as "Digital conference converter 6". Converter 6 then sends its data via the AND link to converter 1 of the module and thus to the main station.

Converter 1 of the module receives the main station signals and passes them on to the other sub-stations. In the transmit direction, this converter 1 is used to send the signals from the sub-stations to the main station.

There is a channel link between converter 1 and channel 6 of port 1. The 2 Mbit/s connection is used to transmit channel 6 to node 1.

In node 1, there is a channel link between channel 6/port2 and converter 4 of the DSK module. The main station is connected to interface 4 of the DSK module.

Channels from another node, e.g. channel 9 / port 2, are applied to a converter available on the module by means of the "STANDARD" operating mode. In the example described, channel 9 is applied to converter 4. Converter 4 must be defined as "Digital conference converter 4" in the central card slot data.

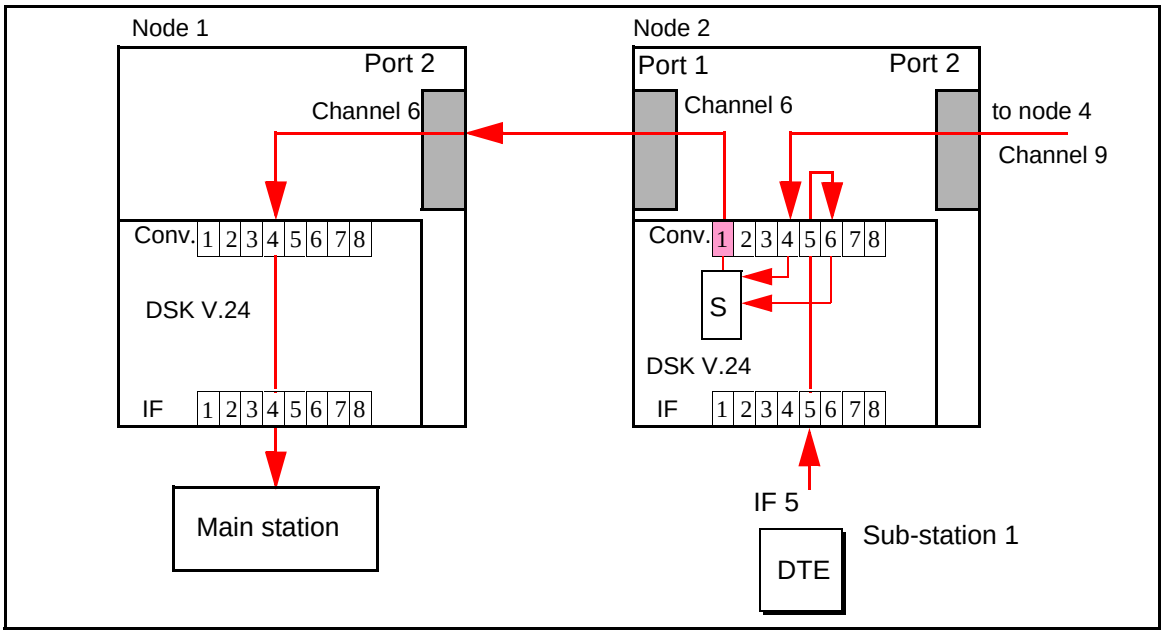


Figure 2.25: Example of a digital conference

2.6.2 Expanded Digital Conference

Using the "Expanded Digital Conference", several subscribers of an XMP1 network can be interconnected to form a conference. The subscriber signals are transmitted in a 64 kbit/s channel via the 2 Mbit/s links of the XMP1 network.

The interfaces/converters of a module involved in an EDC are all equal in priority. The transmit data of each subscriber connected to an interface/converter are forwarded to all other subscribers participating in the EDC. Communication is symmetrical and the behaviour corresponds to that of a subscriber connected to a two-wire bus. For this reason, only half-duplex operation is possible.

In an "Expanded Digital Conference", a terminating unit connected to an interface can act as Master. All other terminating units of this EDC are then used as Slaves. However, this definition is not implemented in the XMP1 system. The Operator himself must define as to which terminating unit shall act as Master or Slave.

The signals supplied by the terminating units are passed through the XMP1 system transparently. The information determined for the individual terminating units must be defined by the latter at protocol level.

In the XMP1 system, the "Expanded Digital Conference" is supported by the following modules (with DIX-ASIC):

- DSK modular MDG
- DSK modular MDV
- DIX QD2ZT add-on

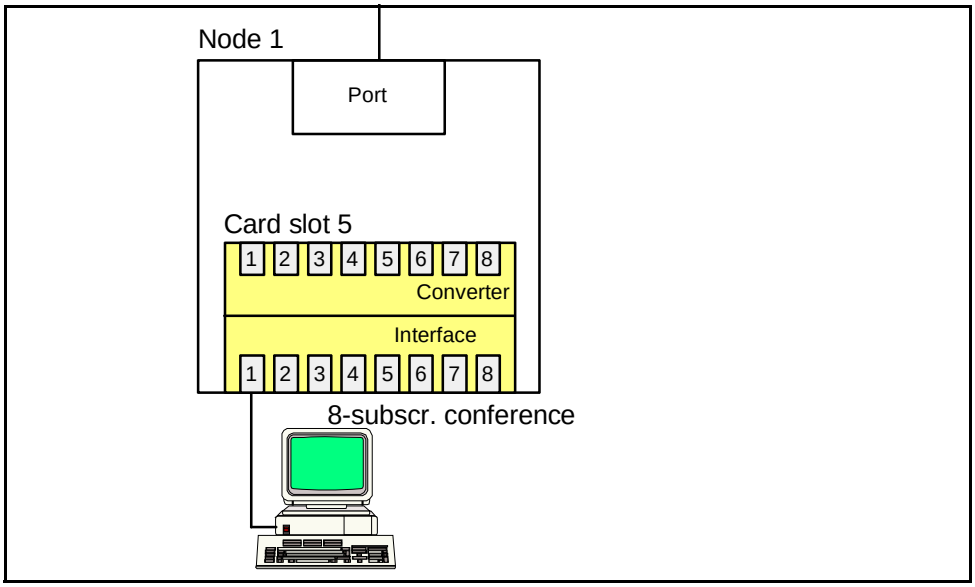
2.6.2.1 8-subscriber/2 x 4-subscriber conference

To ensure a flexible application of the EDC in the network, two different conferences, i.e. the 8-subscriber and 2 x 4-subscriber conference, can be configured.

The configuration necessary for this purpose is performed via the central card slot data of the module.

8-subscriber conference

In case of the **8-subscriber conference**, all 8 sub-addresses available on a module can be used for **one** EDC. The connected subscribers are all involved in one conference.

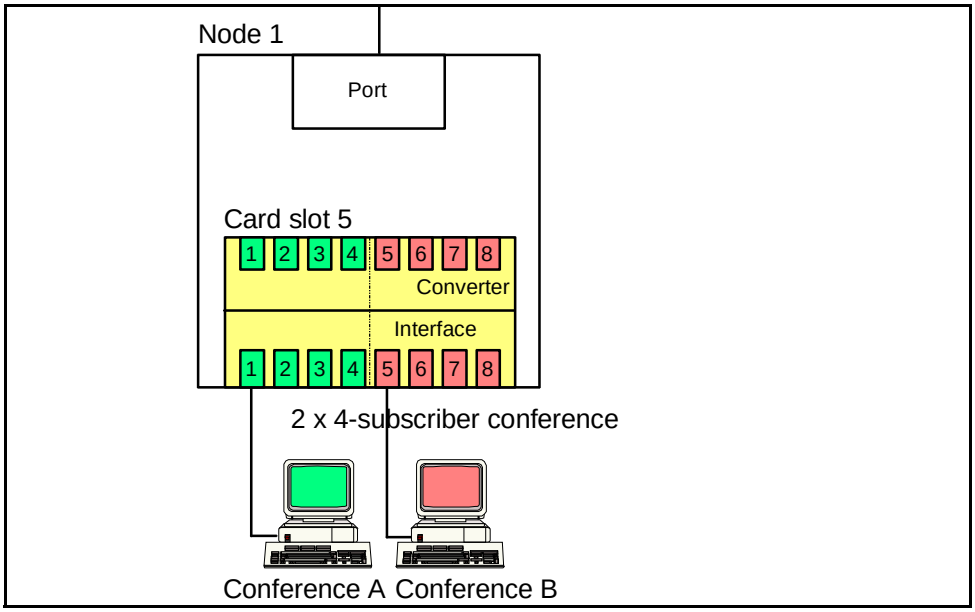


2 x 4-subscriber conference

If the **2 x 4-subscriber conference** mode is adjusted for a module, two groups of
4 sub-addresses of the corresponding module can be assigned to different conferences. Thus, subscribers involved in two separate conferences can be connected to one module.

With this setting, please note the following assignment of sub-addresses:

- Conference 1: uses sub-addresses 1 to 4
- Conference 2: uses sub-addresses 5 to 8



2.6.2.2 Use of sub-addresses

If not all sub-addresses of a module are used for the EDC, please note the following:

- If neither the converter nor interface side of a sub-address is involved in the conference, the corresponding channel can be used for normal operation.
- If only the converter side or interface side of a sub-address is involved in the conference, the side not involved cannot be used.

In an "Expanded Digital Conference", the 8-subscriber or 2 x 4-subscriber conference option can be used for connecting the subscribers.

Note: If only the converter side of a module is involved in a conference, the signal FRSTQ must be tied to 0 V. Thus the module is registered in the system.

2.6.2.3 Conference channel routing

For routing the conference channel, i.e. the so-called main line, a 64 kbit/s channel is configured in the network. In case of two separate conferences, an own 64 kbit/s channel must be provided for each conference. These channels are routed through the network independently of each other.

For routing this conference channel, a "main line" should be defined. The subscribers are then connected along this main line.

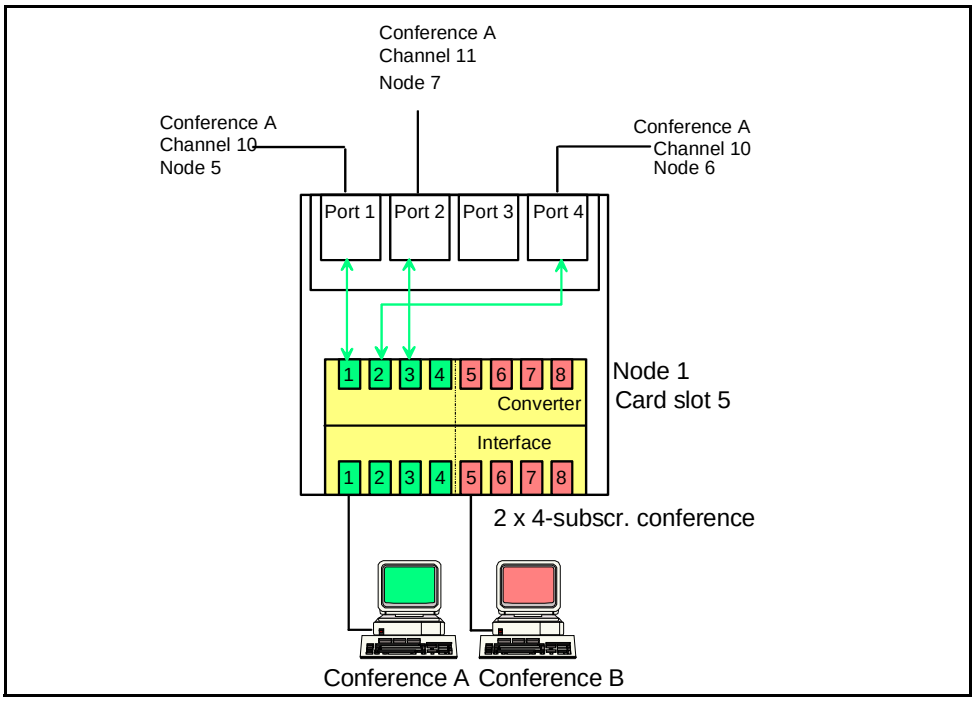
The 64 kbit/s channel of the "main line" is connected to the converters of the modules. For an 8-subscriber conference, converters 1 and 2 must be used. In case of a 2 x 4-subscriber conference, converters 1 and 2 must be used for conference A and converters 5 and 6 for conference B.

The main line is to be routed via converters 1 and 2 and/or 5 and 6 for the following reason.

If a module involved in a conference is pulled out, the conference channel between the other subscribers participating in this conference is not interrupted along the main line. In the corresponding node, the subscriber signals are transmitted between converters 1+2 or 5+6 via the switching matrix. Thus, an interruption of the conference can be avoided. However, please note that other conference subscribers connected via the extracted module as well as branching sub-lines possibly connected will be disconnected.

The converters of a module which are not used for main line channel routing, i.e. converters 3 to 8 in case of an 8-subscriber conference and converters 3+4 as well as 7+8 in case of a 2 x 4-subscriber conference, can be used for connecting further conference subscribers via any interface. Thus, it is possible to include subscribers in a conference via sub-lines.

If only one subscriber is connected in both end nodes of the main line, a simple conference with 1 converter/1 interface can be configured or the subscriber can be connected in the STANDARD operating mode (converter <-> port).



2.6.2.4 Examples

The following EDC examples show a pure 8-subscriber conference and a mixed 8-subscriber and 2 x 4-subscriber conference.

Example of an 8-subscriber conference

All subscribers in this example participate in conference A. The subscribers of conference A are connected via a module configured for an 8-subscriber conference by means of the central card slot data.

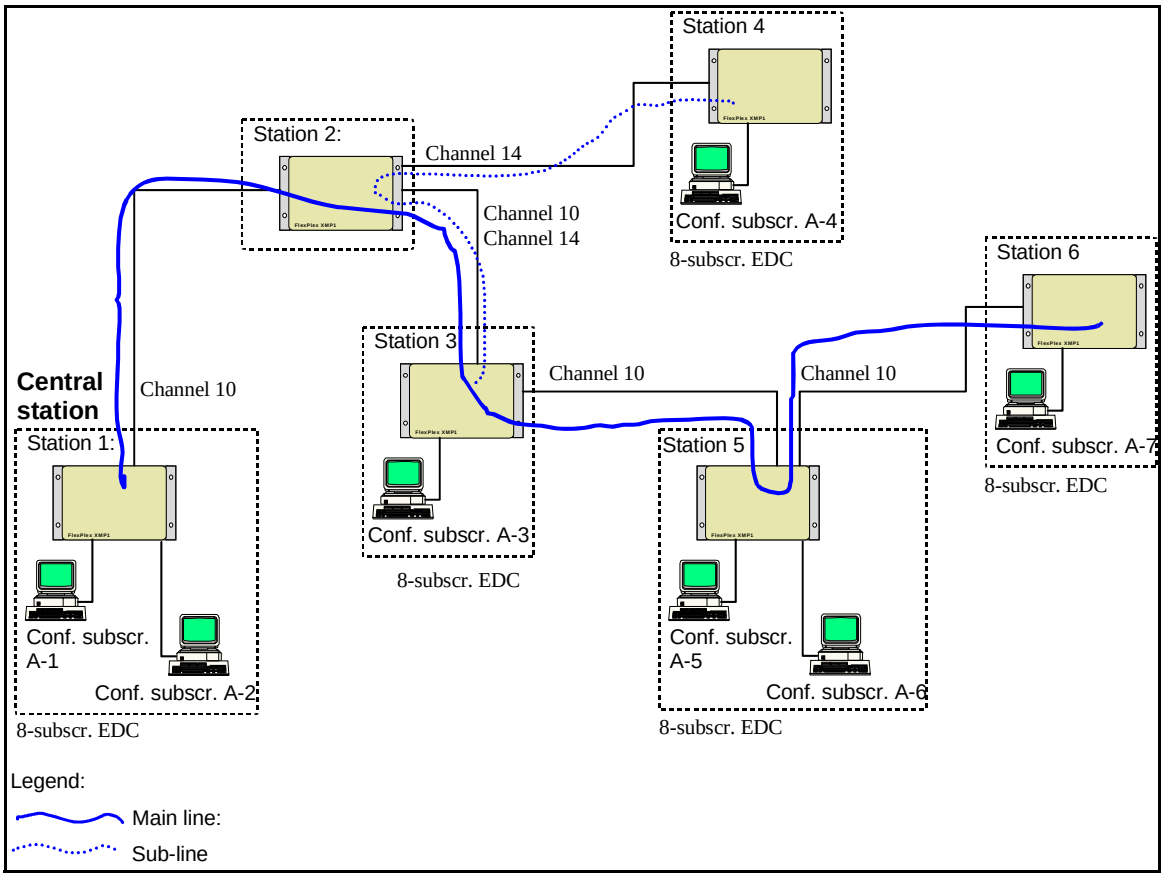


Figure 2.26: Example of an 8-subscriber conference

Main line

The main line of the conference is routed from node 1 (Central Station) via nodes 2, 3, 5 and 6 in channel 10. For main line routing, converters 1 and 2 of the modules are connected to the corresponding ports (64 kbit/s channel). Along this main line, subscribers A-1 to A-3 as well as A-4 to A-7 are involved in the conference.

Sub-line

Subscriber A-4 is connected to the conference in node 3 via a sub-line. For this purpose, channel 14 (subscr. A-4) is switched through transparently in node 2 to node 3. In node 3, this channel 14 is then applied to a free converter.

Alternatively to this solution, a conference can also be configured in node 2. Here only the converters and no interfaces of the module will be involved in the conference. In this case, converters 1 and 2 are also connected to the corresponding ports for main line routing. Channel 14 (subscr. A-4) is applied to a free converter.

Example of a 2 x 4-subscriber and 8-subscriber conference

The example depicted below shows two independent conferences, i.e. conference A and conference B. For this application, the modules used must be adjusted for both the 8-subscriber and 2x4-subscriber conference.

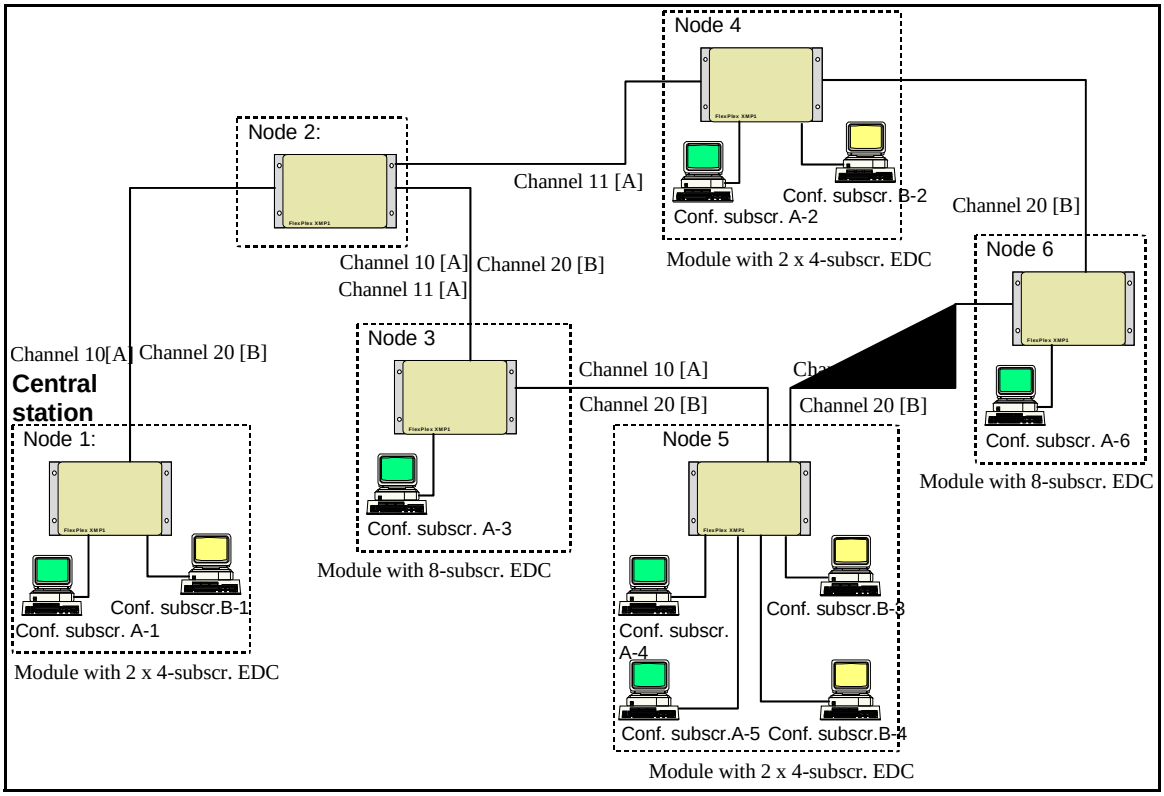


Figure 2.27: Example of an 8-subscriber and 2 x 4-subscriber conference

Conference A subscribers:

- Conference subscriber A-1
- Conference subscriber A-2
- Conference subscriber A-3
- Conference subscriber A-4
- Conference subscriber A-5
- Conference subscriber A-6

Main line - Conference A

The main line of conference A starts in node 1 and is routed in channel 10 [A] via nodes 2, 3 and 5 to node 6. Along this main line, subscribers A-1, A-3, A-4, A-5 and A-6 are connected. Subscriber A-2 is connected to the conference via a sub-line (see below).

For main line B, converters 1 and 2 of the modules are connected to the corresponding ports (64 kbit/s channel).

In node 1, subscriber A-1 is connected to a module configured for a 2 x 4-subscriber conference. Node 1 is used as Central Station for conference A.

In nodes 3 and 6, the subscribers A-3 and A-6 of conference A are connected. Here the module is configured for an 8-subscriber conference.

In node 5, the subscribers A-4 and A-5 are connected to a module configured for the 2x4-subscriber conference mode.

Sub-line - Conference A

Subscriber A-2 in node 4 is transparently routed in channel 11 [A] via node 2 to node 3. There it is connected to conference A via a converter.

Conference B subscribers:

- Conference subscriber B-1
- Conference subscriber B-2
- Conference subscriber B-3
- Conference subscriber B-4

Main line - Conference B

The main line of conference B starts in node 1 and is routed in channel 20 [B] via nodes 2, 3, 5 and 6 to node 4. In nodes 2, 3 and 6, channel 20 [B] is switched through transparently. Subscribers B-1 to B-4 are connected along this main line.

For main line B, converters 5 and 6 of the modules are connected to the corresponding ports.

In node 1, subscriber B-1 is connected to a module configured for the 2x4-subscriber conference mode. Node 1 is used as Central Station for conference B.

In node 5, subscribers B-3 and B-4 are connected to a module configured for the 2x4-subscriber conference mode.

In node 4, subscriber B-2 is connected to a converter of a module configured for the 2x4-subscriber conference mode.

2.6.2.5 Configuration

The following section describes the setting options offered by the central and decentral card slot data of the modules for an "Expanded Digital Conference".

Settings in the central and decentral card slot data are possible for the following modules (with DIX-ASIC):

- DSK modular MDG
- DSK modular MDV
- DIX QD2ZT add-on

Note: The following settings has to be done for the E1 interfaces which are involved in an „Expanded Digital Conference:
Info no. 3: „Disconnect also at Ext.-D & Ext.-Dk“ must be activated.
Otherwise on the E1 interface the signal (user data) in forward direction would be involved in the signal of the backward direction if an on-sided error appears.
Thereby no usable transmission of the conference would be possible.
Info no. 2: „Disconnect immediately when fault“ should be activated. Otherwise the rebuild of the conference starts after 4 to 5 seconds.

Central card slot data

Tab. 2.K: Central card slot data for EDC

Info no.	Designation	Default setting
21	Exp. dig. conf. active (Dec 27-29) yes=1	0
22	Exp. dig. conf. div.: 8=0 2*4(1-4/5-8)=1	0
23	Exp. dig. conf: Master/Slave=0 equal=1	0
24	Exp. Dig. conf: root depends on C/RTSyes=1	0
26	Digital conference - converter 2 yes=1	0
27	Digital conference - converter 3 yes=1	0
28	Digital conference - converter 4 yes=1	0
29	Digital conference - converter 5 yes=1	0
30	Digital conference - converter 6 yes=1	0
31	Digital conference - converter 7 yes=1	0
32	Digital conference - converter 8 yes=1	0

Info no. 21: Exp. Dig. Conf. active

Using this info no., the "Expanded Digital Conference" mode can be adjusted for the module.

> **Note:** In this case of application, info nos. 26 to 32 must not be used and have to be set to "0".

Expanded Digital Conference active:

Info no. 21 set to "1".

Info no. 22: Exp. Dig. conf. div.: 8=0 2*4(1-4/5-8)=1

Using info no. 22, you can define as to whether you want to use this module for switching a large conference with up to 8 sub-addresses or two smaller, separate conferences with 4 sub-addresses each (sub-addresses 1 to 4 or 5 to 8).

Expanded Digital Conference with 8 sub-addresses:

Info no. 22 set to "0".

Expanded Digital Conference with 2 x 4-subscriber sub-addresses:

Info no. 22 set to "1".

Info no. 23: Exp. Dig. conf: Master/Slave=0 equal=1

Expanded Digital Conference: Master/Slave operation:

Using this info no. you can adjust whether the digital conference shall take place in the Master/Slave mode or with equal subscribers.

Master/Slave mode

The tree must be set up starting from the bus Master. The signal from the Master is sent to all Slaves, whereas the signals supplied by the Slaves are sent only to the root. This corresponds to a four-wire bus and is basically appropriate for **full-duplex** operation.
This mode must also be used if the Master fills the pauses between telegrams with data other than the Idle signal (e.g. HDLC flags in case of SISA).

Info no. 23 set to "0".

Expanded Digital Conference: equal

Equal operation

This mode is typical for operation without a permanent Master (e.g. professional bus with token ring or telephone conference between subscribers). The signal of each subscriber is sent to all other subscribers. This corresponds to a two-wire bus and is basically only appropriate for **half-duplex** operation.

In order to permit "ripping up" meshes, a tree must still be set up starting from a root. However, this tree is independent of traffic signal transmission.

Info no. 23 set to "1".

Info no. 24: Exp. Dig. conf: Root depends on C/RTS yes=1

For special cases of application, it is possible to configure several roots, i.e. Masters. Using this card slot information, you can define that one of the Masters configured can declare itself as Master by activating a control line.

> **Note:** This option is not applicable to G.703 or WT modules, since control lines are not available.

Decentral card slot data

Tab. 2.L: Decentral card slot data for EDC

Info no.	Designation	
14	Preferred path for conference	yes=1
27	Sync. Freq.|EDK: conv. takes part	yes=1
28	Sync. Freq.|EDK: Intf. takes part	yes=1
29	Sync. Freq.|EDK: intf. root poss.	yes=1

Info no. 14: Preferred path for conference

Using this info no., you can define the interface or converter located in the preferred conference path. This path will then be preferred as return direction to the root (Master). The alternativ path is used if the preferred path is not available. If the fault in the preferred path is resolved this path will be used again.

Info nos. 27 to 29: Sync.Freq.| EDK

Info nos. 27 to 29 can assume two different meanings:

1. With an EDC active on the module (setting via central card slot info no. 21:
   = 1, the settings are applicable to the Expanded Digital Conference.
2. With info no. 21: Central =0, the previous meaning "Info no. 21: Frequency table" will apply.

Info no. 27: Sync.Freq.| EDK: conv. takes part yes=1

The converter of the sub-address will be involved in the conference.

Info no. 28: Sync.Freq.| EDK: intf. takes part yes=1

The interface of the sub-address will be involved in the conference.

Info no. 29: Sync.Freq.| EDK: intf. root poss. yes=1

Using this info no., you can define the subscriber unit connected to the interface as Master.

Common conference circuit

The schematic drawing depicted below shows a conference circuit with all subscribers participating in the same conference.

Subscribers 1 to 6 in nodes 1, 2, 3 and 4 all participate in a common conference.

Main line

The main line of the conference is routed in channel 11 from node 1 via node 2, port 1, and node 2, port 3, to node 3.

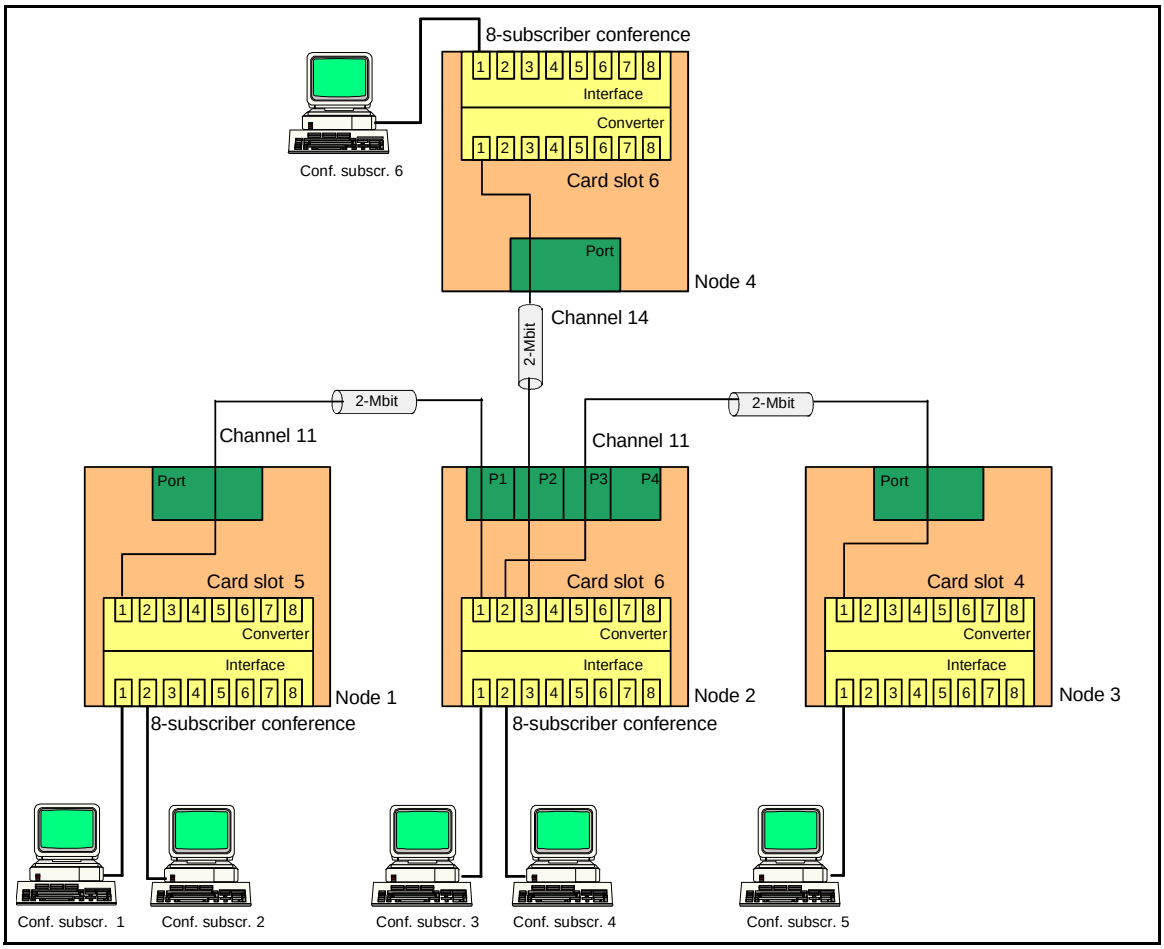
In node 2, this channel 11 is switched from port 1 to converter 1 and from port 3 to converter 2 in the STANDARD operating mode (port <-> converter).

Node 3, i.e. the end node of the main line, is not configured for an EDC. Here subscriber 5 is configured for the STANDARD operating mode with channel 11.

Sub-line

Subscriber 6 in node 4 is to participate in the conference in node 2 via a sub-line.

Subscriber 6 of node 4 is routed in channel 14, which is connected in node 2 from port 2 to converter 3.



For this conference circuit, the following configurations must be performed in the individual nodes via the central and decentral card slot data.

Node 1 for card slot 5

Central card slot data

- Info no. 21: Set to "1"; EDC active
- Info no. 22: Set to "0"; 8-subscriber conference
- Info no. 23: Set to "1"; equal
- Info no. 24: without any meaning

Decentral card slot data
SUB-ADDRESS 1:

- Info no. 27: Set to "1"; converter takes part in conference
- Info no. 28: Set to "1"; interface takes part in conference
- Info no. 29: without any meaning

SUB-ADDRESS 2:

- Info no. 27: Set to "0"; converter does not take part in conference

- Info no. 28: Set to "1"; interface takes part in conference
- Info no. 29: without any meaning

Node 2 for card slot 6

Central card slot data

- Setting identical with that for node 1.

Decentral card slot data
SUB-ADDRESS 1:

- Info no. 27: Set to "1"; converter takes part in conference
- Info no. 28: Set to "1"; interface takes part in conference
- Info no. 29: without any meaning

SUB-ADDRESS 2:

- Info no. 27: Set to "1"; converter takes part in conference
- Info no. 28: Set to "1"; interface takes part in conference
- Info no. 29: without any meaning

SUB-ADDRESS 3:

- Info no. 27: Set to "1"; converter takes part in conference
- Info no. 28: Set to "0"; interface does not take part in conference
- Info no. 29: without any meaning

Node 3 for card slot 4

This end node of the main line is not configured for an EDC. The subscriber is connected and operated in the STANDARD mode.

Node 4 for card slot 6

Central card slot data

- Info no. 21: Set to "1" ; EDC active
- Info no. 22: Set to "0" ; 8-subscriber conference
- Info no. 23: Set to "1"; equal
- Info no. 24: without any meaning

Decentral card slot data

SUB-ADDRESS 1:

- Info no. 27: Set to "1"; converter takes part in conference
- Info no. 28: Set to "1"; interface takes part in conference
- Info no. 29: without any meaning

Two separate conference circuits

In the example depicted below, two separate conferences, i.e. conference A and conference B, are configured in the network.

Conference A

Subscribers A-1 to A-6 participate in conference A. Subscriber A-6 is connected to conference A in node 2 via port 2.

Main line

The main line of conference A is routed in channel 11 from node 1, port 1, via node 2, port 1 and port 3, to node 3, port 1.

For setting up this main line, converters 1 and 2 of the modules are connected to the corresponding ports in both node 1 and node 2.

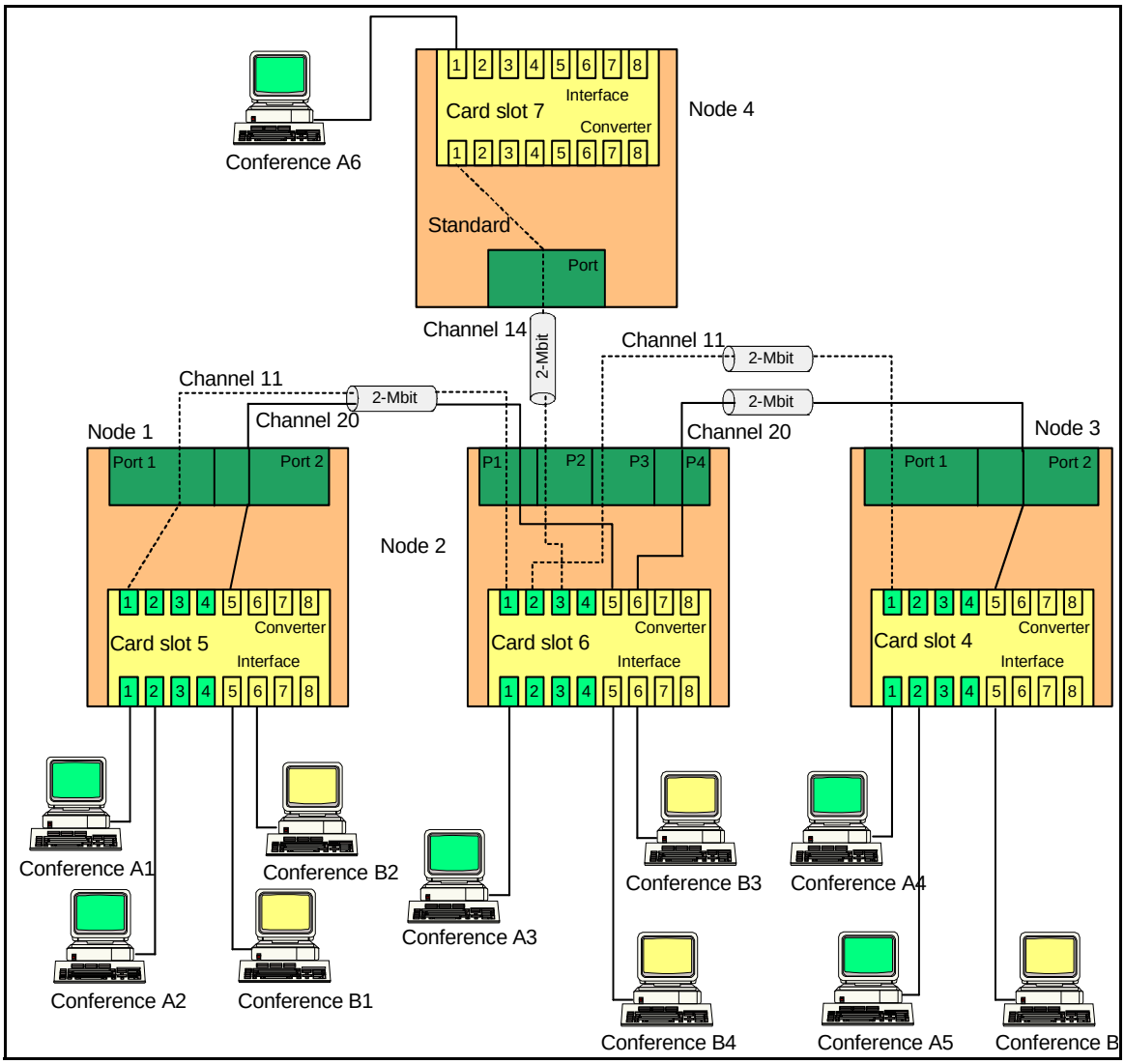
Sub-line

Subscriber A-6 is routed in channel 14 from node 4 to node 2 and is connected there to converter 3.

Conference B

Subscribers B-1 to B-5 participate in conference B.

The conference channel B (64-kbit/s) of conference B is routed from node 1, port 2, via node 2, port 1 and port 4, to node 4, port 2.



For these conference circuits, the following configurations must be performed in the individual nodes via the central and decentral card slot data.

Node 1 for card slot 5

Central card slot data

- Info no. 21: Set to "1"; EDC active
- Info no. 22: Set to "1"; 2 x 4-subscriber conference
- Info no. 23: Set to "1"; equal
- Info no. 24: without any meaning

Decentral card slot data

SUB-ADDRESS 1 for conference A:

- Info no. 27: Set to "1"; converter takes part in conference
- Info no. 28: Set to "1"; interface takes part in conference

- Info no. 29: without any meaning

SUB-ADDRESS 2 for conference A:

- Info no. 27: Set to "0"; converter does not take part in conference
- Info no. 28: Set to "1"; interface takes part in conference
- Info no. 29: without any meaning

SUB-ADDRESS 5 for conference B:

- Info no. 27: Set to "1"; converter takes part in conference
- Info no. 28: Set to "1"; interface takes part in conference
- Info no. 29: without any meaning

SUB-ADDRESS 6 for conference B:

- Info no. 27: Set to "0"; converter does not take part in conference
- Info no. 28: Set to "1"; interface takes part in conference
- Info no. 29: without any meaning

Node 2 for card slot 6

Central card slot data

- Info no. 21: Set to "1"; EDC active
- Info no. 22: Set to "1"; 2 x 4-subscriber conference
- Info no. 23: Set to "1"; equal
- Info no. 24: without any meaning

Decentral card slot data

SUB-ADDRESS 1 for conference A:

- Info no. 27: Set to "1"; converter takes part in conference
- Info no. 28: Set to "1"; interface takes part in conference
- Info no. 29: without any meaning

SUB-ADDRESS 2 for conference A:

- Info no. 27: Set to "1"; converter takes part in conference
- Info no. 28: Set to "0"; interface does not take part in conference
- Info no. 29: without any meaning

SUB-ADDRESS 3 for conference A:

- Info no. 27: Set to "1"; converter takes part in conference
- Info no. 28: Set to "0"; interface does not take part in conference
- Info no. 29: without any meaning

SUB-ADDRESS 5 for conference B:

- Info no. 27: Set to "1"; converter takes part in conference
- Info no. 28: Set to "1"; interface takes part in conference
- Info no. 29: without any meaning

SUB-ADDRESS 6 for conference B:

- Info no. 27: Set to "1"; converter takes part in conference
- Info no. 28: Set to "1"; interface takes part in conference
- Info no. 29: without any meaning

Node 3 for card slot 4

Central card slot data

- Info no. 21: Set to "1"; EDC active
- Info no. 22: Set to "1"; 2 x 4-subscriber conference
- Info no. 23: Set to "1"; equal
- Info no. 24: without any meaning

Decentral card slot data

SUB-ADDRESS 1 for conference A:

- Info no. 27: Set to "1"; converter takes part in conference
- Info no. 28: Set to "1"; interface takes part in conference
- Info no. 29: without any meaning

SUB-ADDRESS 2 for conference A:

- Info no. 27: Set to "0"; converter does not take part in conference
- Info no. 28: Set to "1"; interface takes part in conference
- Info no. 29: without any meaning

SUB-ADDRESS 5 for conference B:

- Info no. 27: Set to "1"; converter takes part in conference
- Info no. 28: Set to "1"; interface takes part in conference
- Info no. 29: without any meaning

Node 4 for card slot 7

This node is not configured for an EDC. The subscriber is connected and operated in the STANDARD mode.

2.6.3 Analog Conference

The "Analog Conference" option is supported by XMP1 version 3.8 and higher. It is implemented by a software package. This software runs on the processor of the KZU FEK (8) module (62.7040.250.00-A001, AN00113903).

In the XMP1 node, this KZU FEK (8) module is mounted in any card slot of the XMP1 subrack. In the Operator Terminal, not the KZU FEK (8) module, but the "CNF Analog Conference" module is entered in the Node Equipment. This module represents the Analog Conference functionality.

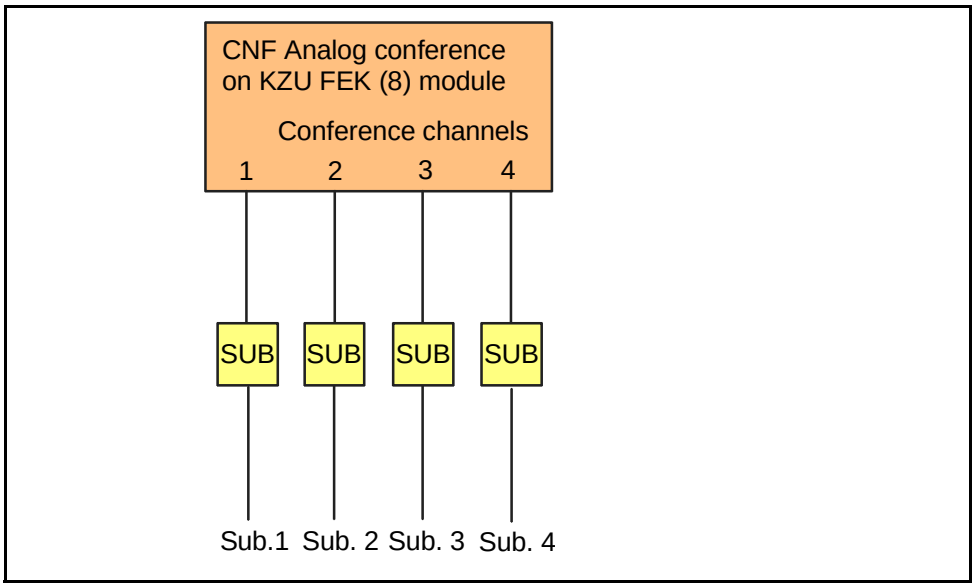
The "CNF Analog Conference" module provides up to four analog conference channels for configuring an "analog conference". The subscribers of a conference are connected to these conference channels via subscriber interfaces (KZU SUB and KZU FEK).

> **Note:** If the KZU FEK (8) module is used for the "Analog conference", an application as a pure KZU FEK (8) module is no longer possible irrespective of the number of conference channels used.

> **Note:** The following settings has to be done for the E1 interfaces which are involved in an „analogue conference“:
> **Info no. 3**: „Disconnect also at Ext.-D & Ext.-Dk“ must be activated.
> Otherwise on the E1 interface the signal (user data) in forward direction would be involved in the signal of the backward direction if an on-sided error appears.
> Thereby no usable transmission of the conference would be possible.
> **Info no. 2:** „Disconnect immediately when fault“ should be activated. Otherwise the rebuild of the conference starts after 4 to 5 seconds.

In case of an analog conference, a distinction is made between the following options:

- Analog conference with signalling (a-bit)
- Analog conference without signalling (modem mode)



Cascading

Cascading the "CNF Analog Conference" module is possible. Thus, more than four conference subscribers can be interconnected to a conference. These modules can be mounted either in one or in several nodes. Using one "CNF Analog Conference" module, up to four connections can be set up either to another module or to a 2 Mbit/s port.

The following conference channel connections are possible:

[1]Conference channel x with a converter of a subscriber interface operated in the "STANDARD" mode.

[2]CNF X module, conference channel x with CNF Y module; conference channel y operated in the "STANDARD" mode.

[3]Conference channel x with a 64 kbit/s channel of a port operated in the "STANDARD" mode.

When cascading an analog conference, please note that the maximum number of conference channels depends on the basic noise of the channels involved.

The following diagram shows an example of such a cascade.

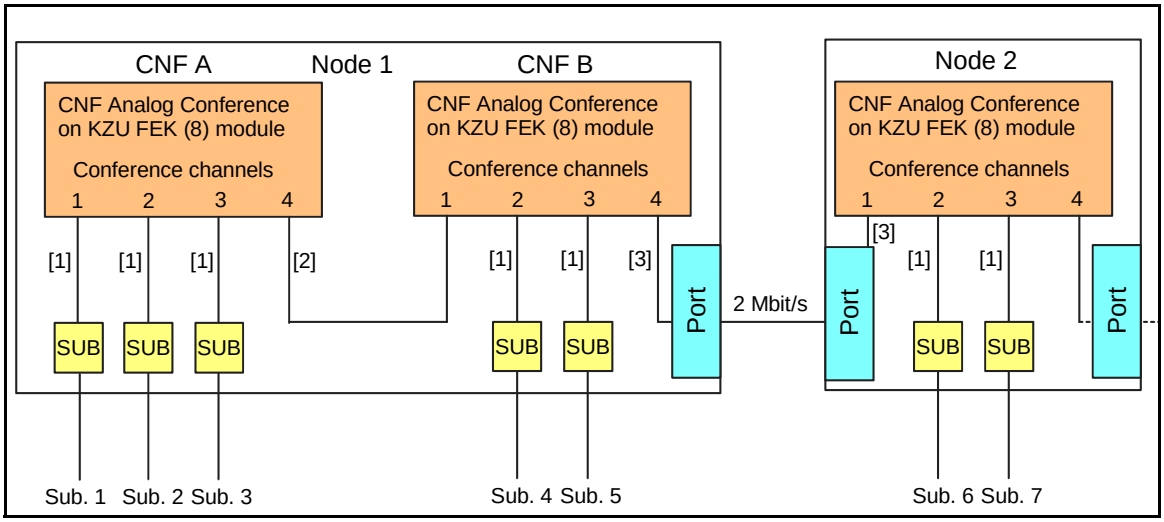


Figure 2.28: Cascading the analog conference

In node 1, the conference channels 1, 2 and 3 of the CNF A conference module are configured with subscribers 1, 2 and 3 in the "STANDARD" mode.

Cascading in node 1 takes place between the CNF A and CNF B module by configuring the conference channels 4 and 1 to operate in the "STANDARD" mode. The conference channels 2 and 3 of the CNF B module are configured to operate in the "STANDARD" mode with subscribers 4 and 5.

Cascading between node 1 and node 2 is executed by connecting conference channel 4 of node 1 to conference channel 1 of node 2. This connection is set up in the "STANDARD" mode. The conference channels 2 and 3 in node 2 are configured again to operate in the "STANDARD" mode with subscribers 6 and 7. Conference channel 4 in node 2 can be used for further cascading.

2.6.3.1 Analog conference with signalling

The output signal of each analog conference channel (to the subscriber) represents the sum of all input signals participating in the conference minus the own input signal.

Each conference channel which detects an active a-bit (a-bit = 0) in the incoming direction actively participates in the conference. This means, that its signal is added up to the other signals. A conference channel with an incoming passive a-bit (a-bit = 1) participates passively in the conference, i.e. this channel is only listening in.

Starting up a conference

The conference is in its basic status if none of the incoming a-bits (from subscribers) is active. In the incoming direction, all a-bits are "1". If the conference detects the first incoming a-bit=0 at one of the conference

channels, its sends an outgoing active a-bit=0 to all other subscribers connected to the conference. Then the conference is in the calling state. If a second active a-bit is now detected (one of the subscribers went off-hook; a-bit=0), the outgoing a-bits of the conference channels are switched passive by an incoming passive a-bit (traffic state). The outgoing a-bits of the subscribers participating in the conference call are active and show that they are in the calling status.

Adding / deleting conference channels in the traffic state

If the conference detects a new channel with an active a-bit, this channel is involved in the conference and the outgoing a-bit of this channel is switched active.

As soon as a channel with a passive a-bit is detected in the conference, its signal is excluded from the conference and the outgoing a-bit is switched passive.

Terminating the conference

As long as a conference channel includes an active a-bit (from the subscriber), the conference remains in the traffic state.

If there is only one more active conference channel, its outgoing a-bit (to the subscriber) is switched passive by the conference circuit. This indicates that there is no other conference channel participating in the conference. As soon as the incoming a-bit of the last conference channel becomes passive, the conference returns to its basic state.

2.6.3.2 Analog conference without signalling (modem mode)

With XMP1 version 3.8.5 and higher, the "Analog conference" can be configured in such a way that a control function using the a-bit is no longer necessary.

On all CNF modules involved in the "Analog conference", the central card slot data bit 1 "Modem mode (without signalling)" must be set to 1. Thus, all conference channels without AIS are involved in the conference independent of any incoming signalling data.

In order to ensure operation in the SUB-SUB mode, incoming signalling data available at a port are looped back to the latter. This means, if the S2in line of an FEK channel becomes active, its S2out line also becomes active. However, this does not affect the conference.

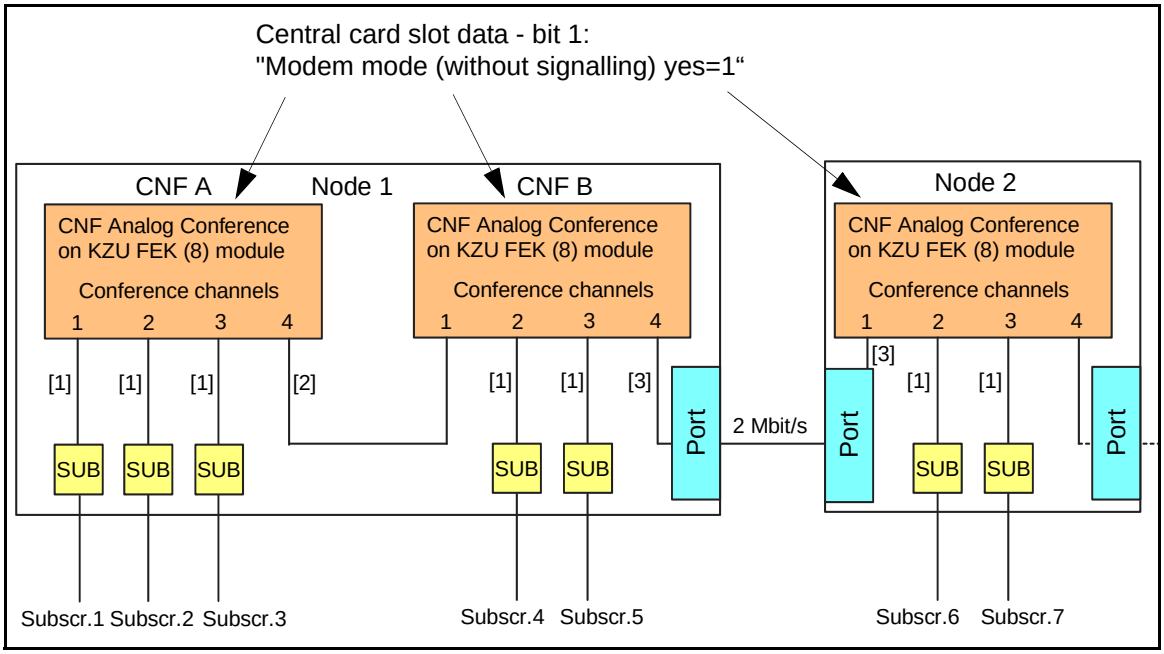


Figure 2.29: Analog conference in modem mode (without signalling)

Usable interfaces

All analog XMP1 interfaces can be used to connect subscribers to an analog conference.

However, in normal cases of application, the SUB and FEK interfaces are used for this purpose.

> **Note:** When using a SUB module, the SUB-SUB operating mode must be configured (decentral card slot data - bit 23 = 1).

Configuration

The configuration of the analog conference is executed in the same way as a normal module configuration.

1. Define the run of the analog conference (nodes, card slots, ports, channels etc.).
2. Mount the KZU FEK (8) module(s) you want to use for the analog conference.

   Note: Since a KZU FEK (8) module used as conference module has no front cable connections, it must be ensured that - after mounting this module - the FRSTQ signal is tied to 0 V. For this purpose a D-Sub connector (D-Sub F25 M3/S KPL Part no. AN00055910) is used.
   On this D-Sub connector, PIN 13 must be connected to the connector housing. The FRSTQ is then tied to 0 V when the FRSTQ D-Sub connector is plugged in.
   This connection must be removed again before extracting the module.

3. Mount the modules (SUB, FEK) you want to use for connecting the conference subscribers. When using the SUB module, the SUB-SUB operating mode must be configured.
4. At the Operator Terminal (MSP, SOX), the special "CNF Analog Conference" module must be entered in the Node Equipment for the card slots provided for the KZU FEK (8) module to be used as conference module.

   Note: When using the MSP, the sub-addresses must have been previously entered.

5. Special settings are not required on the conference module. The central and decentral card slot data of the "CNF Analog Conference" module do not allow any settings.

   Note: In case of an "Analog conference" in the "modem mode", bit 1 of the central card slot data must be set to "1" for all CNF modules.

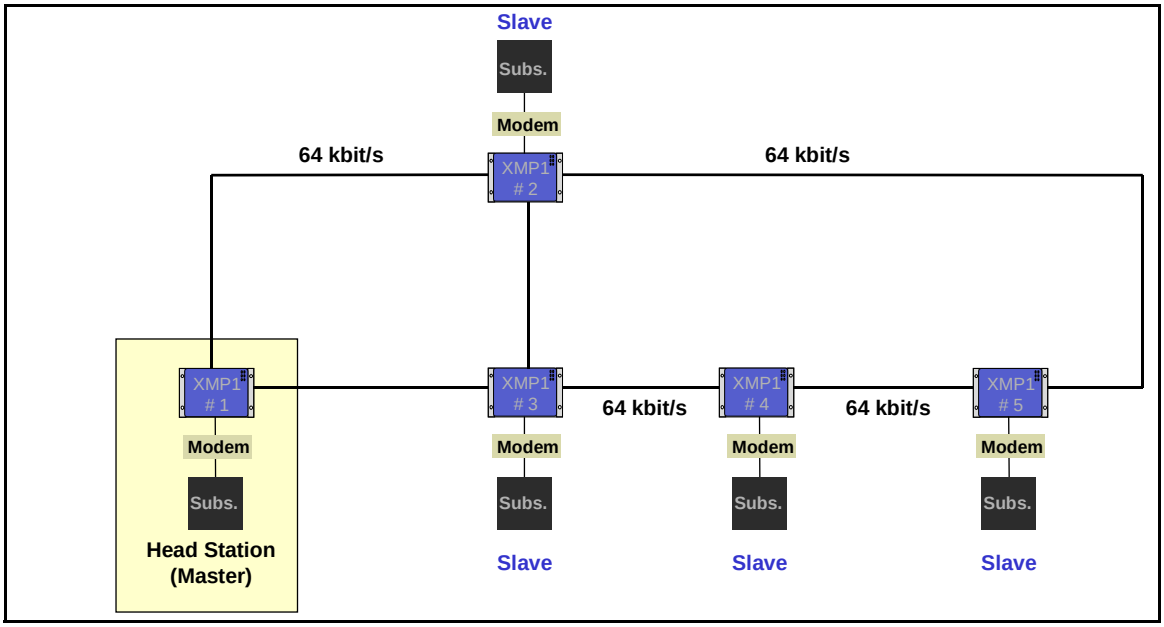
6. Switch the conference channels in accordance with the defined run. Use the "Standard" mode.

2.6.4 Branching function

In contrast to the conference configurations possible so far, a higher security can now be achieved by switching a conference in an arbitrarily meshed topology. Relevant in this case is the topology set up using 64 kbit/s channels switched between the ports of the corresponding conference nodes.

To "rip up" meshes, a tree with an unambiguous root is set up automatically. In case of a fault or failure, this tree adapts itself automatically to the changed topology. The algorithm used for this purpose is identical with that required for the service channel necessary for communication between the management system and XMP1 nodes. This also applies to the behavior in case of interruptions.

The following diagram shows an example of a conference.



The **branching function** of the XMP1 system permits automatic and fault-tolerant routing in meshed networks. The subscriber signal is transmitted in a 64 kbit/s channel between the different subscribers participating in the conference. This function is supported both for analog and digital conferences.

The **analog branching function** is supported by the KZU FEK (8) module. This module offers four analog conference channels for the branching function. For this purpose, the "CNF analog conference" module must be provided in the operating software.

The **digital branching function** is supported by the "DSK modular" module equipped with all V- and G-interfaces. Up to 8 subscribers can be configured here. Another important application option for the digital branching function is the protection of the 64 kbit/s SOA management channel when using QD2 and QD2/GN Central Units.

Defining the root (Master)

For both applications, an externally connected subscriber unit can be defined as Master.
This configuration is possible by setting the decentral card slot info. no. 29 to "Root possible at IF" for the DSK module and info no. 29 to "Root for (analog) conference" for the CNF module (FEK).
All other external conference subscribers will then be used as Slaves.

For special applications it is possible to define several roots (Masters). In this case, one of the external units connected to the corresponding interfaces must declare itself as Master by activating a control line. Central card slot info no. 24 must then be set to "Root independent of C/RTS". If this Master fails, another possible Master will take over the Master function. The setup of the new structure will take place automatically.

Automatic tree setup

The tree is set up automatically as soon as the root node (Master) sends out a forward identifier. This identifier is detected and passsed on by the subsequent conference nodes. The direction from which this identifier has been received, will then be defined as return direction to the root (Master).

Definition of a preferred path

If required, a preferred path can be defined. The corresponding configuration is possible via info no. 14 "Preferred path for conference" of the decentral card slot data. This direction will then be preferred as return direction to the root (Master) if the forward identifier has been detected coming from this direction.

Behavior in case of a fault or failure

Interruptions in the 64 kbit/s channel will be indicated means of an AIS in the CAS signalling.

2.6.4.1 Configuration example: one master, no preferred path

The following Fig. 2.30 shows a digital conference with one Master in Master/Slave operation. A preferred path is not configured.

Master of the conference is conference subscriber 1. The Master is connected in node 1 to interface 1 of card slot 5. The Slaves are located in node 2, 3 and 4.

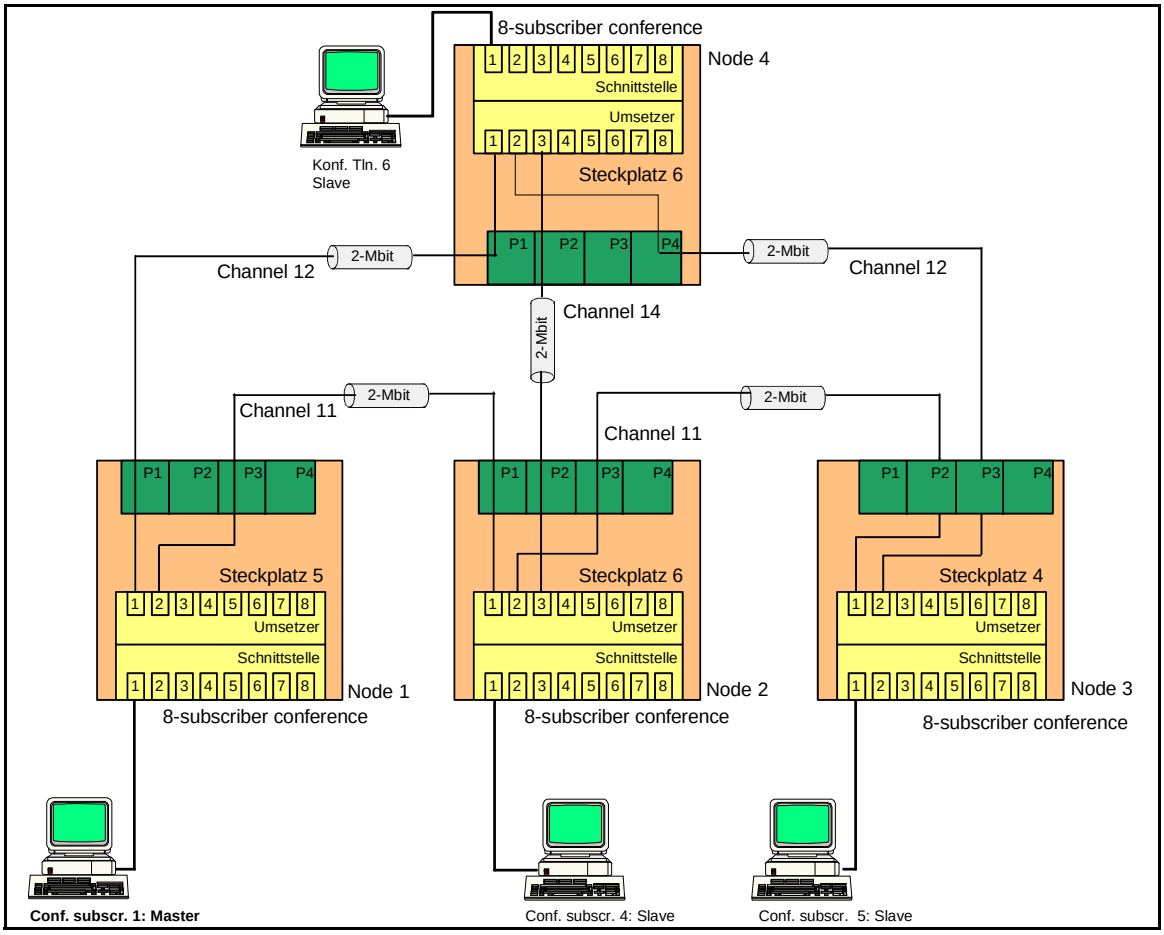


Figure 2.30: Digital conference - Master/Slave mode

Configuration steps to be executed for this example.

Tab. 2.M: Configuration table, Digital conference - Master/Slave mode

Node	Card slot	Sub-addr.	Central card slot info no.				Decentral card slot ino no.				Remark
			21	22	23	24	14	27	28	29	
1	5	1	1	0	0	0	0	1	1	1	Master
		2					0	1	0	0	
2	6	1	1	0	0	0	0	1	1	0	Slave
		2					0	1	0	0	
		3					0	1	0	0	
3	4	1	1	0	0	0	0	1	1	0	Slave
		2					0	1	0	0	
4	6	1	1	0	0	0	0	1	1	0	Slave
		2					0	1	0	0	
		3					0	1	0	0	

Tab. 2.N: Central card slot data for EDC

Info no.	Designation	
21	Exp. dig. conf. active (Dec 27-29)	yes=1
22	Exp. dig. conf. div.: 8=0	2*4(1-4/5-8)=1
23	Exp. dig. conf: Master/Slave=0	equal=1
24	Exp. Dig. conf: root depends on C/RTS	yes=1

Tab. 2.O: Decentral card slot data for EDC

Info no.	Designation	
14	Preferred path for conference	yes=1
27	Sync. Freq.|EDK: conv. takes part	yes=1
28	Sync. Freq.|EDK: Intf. takes part	yes=1
29	Sync. Freq.|EDK: intf. root poss.	yes=1

2.6.4.2 Configuration example: one master, with preferred path

The following Fig. 2.30 shows a digital conference with one Master in Master/Slave operation. A preferred path is defined.

Master of the conference is conference subscriber 1. The Master is connected in node 1 to interface 1 of card slot 5. The Slaves are located in node 2, 3 and 4. A preferred path is defined for interface 1 in node 4, interface 1 in node 2 and interface 1 in node 3.

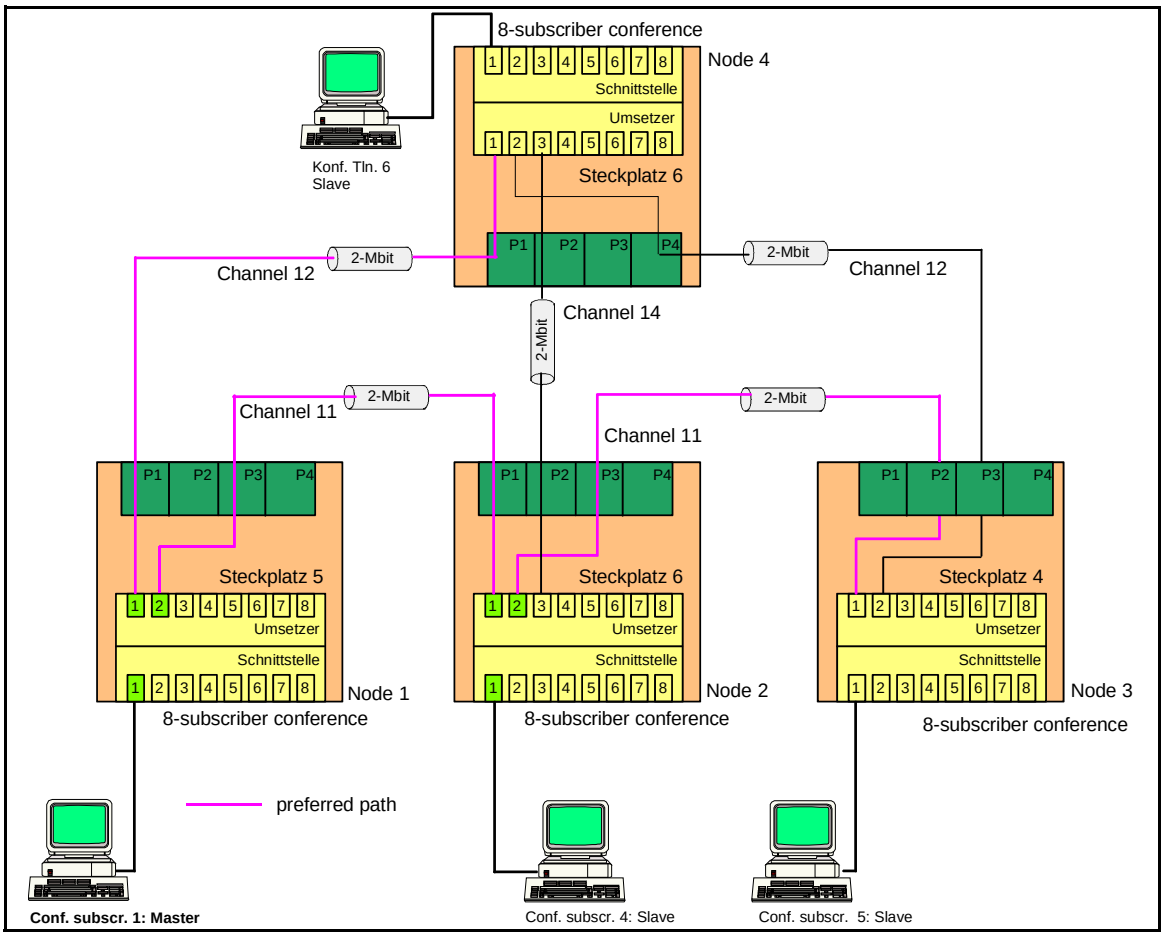


Figure 2.31: Digital conference - Master/Slave mode

Configuration steps to be executed for this example:

Tab. 2.P: Configuration table, Digital conference - Master/Slave mode

Node	Card slot	Sub-addr.	Central card slot info no.				Decentral card slot ino no.				Remark
			21	22	23	24	14	27	28	29	
1	5	1	1	0	0	0	0	1	1	1	Master
		2					0	1	0	0	
2	6	1	1	0	0	0	1	1	1	0	Slave, preferred path
		2					0	1	0	0	
		3					0	1	0	0	
3	4	1	1	0	0	0	1	1	1	0	Slave, preferred path
		2					0	1	0	0	
4	6	1	1	0	0	0	1	1	1	0	Slave, preferred path
		2					0	1	0	0	
		3					0	1	0	0	

2.6.4.3 Configuration example: multiple master defined

The following Fig. 2.30 shows a digital conference in Master/Slave operation with two possible Master.

Conference subscriber 1 and 4 are possible master. Please not that only one Master may be active, the other Master operates as a slave. The Master must declare itself as Master by activating a control line. The Slaves are located in node 3 and 4.

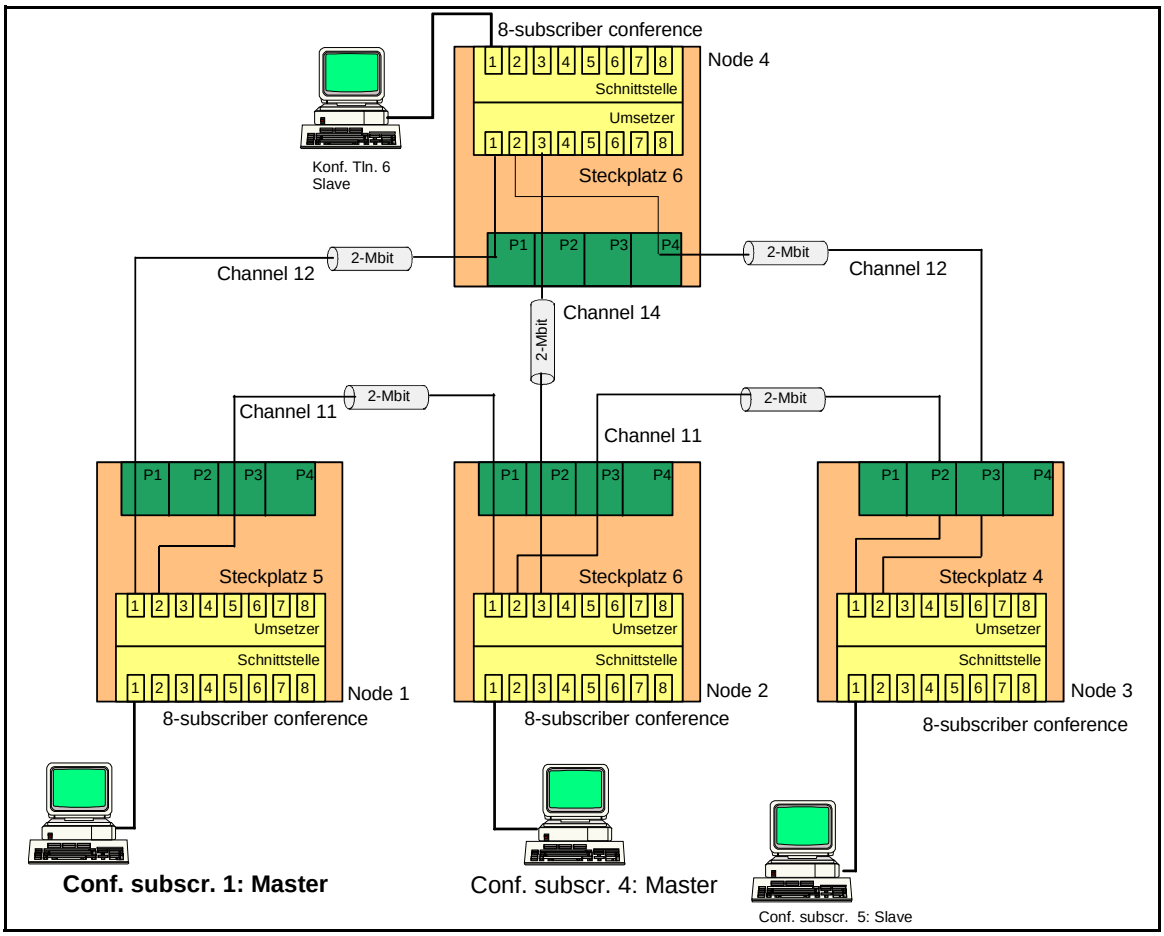


Figure 2.32: Digital conference - Master/Slave mode

Configuration steps to be executed for this example.

Tab. 2.Q: Configuration table, Digital conference - Master/Slave mode

Node	Card slot	Sub-addr.	Central card slot info no.				Decentral card slot ino no.				Remark
			21	22	23	24	14	27	28	29	
1	5	1	1	0	0	0	0	1	1	1	possible Master
		2					0	1	0	0	
2	6	1	1	0	0	0	1	1	1	0	possible Master
		2					0	1	0	0	
		3					0	1	0	0	
3	4	1	1	0	0	0	1	1	1	0	Slave
		2					0	1	0	0	
4	6	1	1	0	0	0	1	1	1	0	Slave
		2					0	1	0	0	
		3					0	1	0	0	

2.7 Protection Switching Configurations

In order to ensure optimum reliability and availability of XMP1 even in case of faults occurring in the network, the system offers the possibility of defining protection switching configurations. The following protection switching configurations are possible:

- Line protection switching
- Card protection switching

2.7.1 2 Mbit/s line protection switching

In line protection switching configurations, 2 Mbit/s data transmission between two nodes is doubled by a second line. In this case, two port LEs are operated in parallel in each node in the Tx direction. The Tx signal is transmitted parallelly over both transmission paths.

Criteria for switchover to the protection path are

- AIS
- LOS
- LOF
- BER^{-3}.

On detection of one of the above conditions in the operating path, the control computer switches over to the protection path. A network management system is not required for switchover.

Note: The protection path must not be occupied by 64 kbit/s channels.

The automatic switchback function from the protection path to the operating path (preferred path) if the switchover condition is no longer available can be configured. When entering the routing data, please ensure that time slot 0 of the 2 Mbit/s signal is transmitted transparently between the terminal stations.

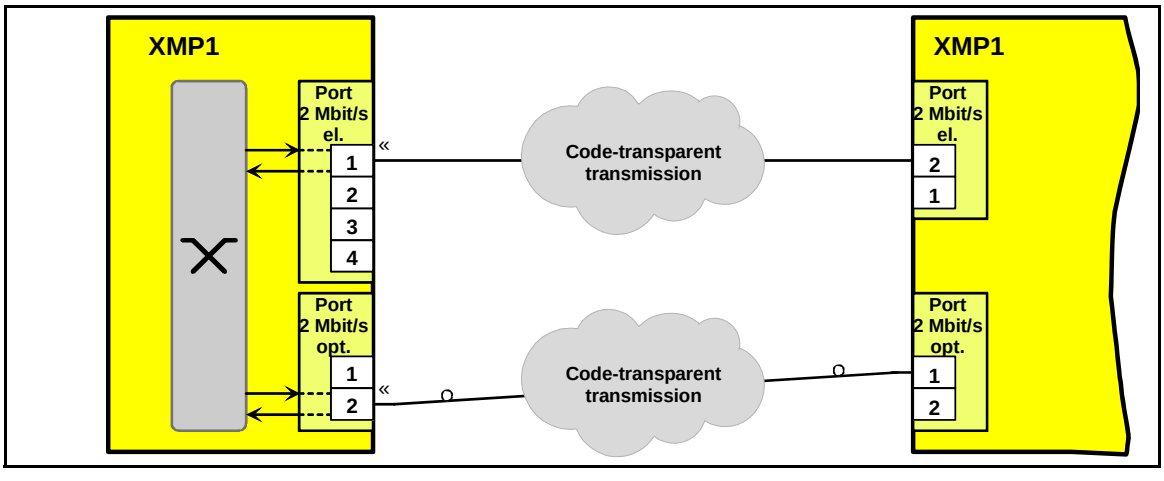


Figure 2.33: Line protection switching

2.7.2 2 Mbit/s card protection switching

In a card protection switching configuration, two port modules are used for protection switching. In this case, an interface (priority) located on one port is protected by a standby interface located on a second port. For both ports, the same subaddress has to be used for both the preferred interface and standby interface.

Up to 16 port interfaces can be doubled in a node.

Criteria for switchover to the protection path are

- AIS
- LOS
- LOF
- BER^{-3}.

If one of the above criteria is detected in the preferred path, switchover to the protection path takes place. A network management system is not required for switchover. The automatic switchback function from the standby path to the preferred path can be configured.

When entering the routing data, please ensure that time slot 0 of the 2 Mbit/s signal is transmitted transparently between the terminal stations.

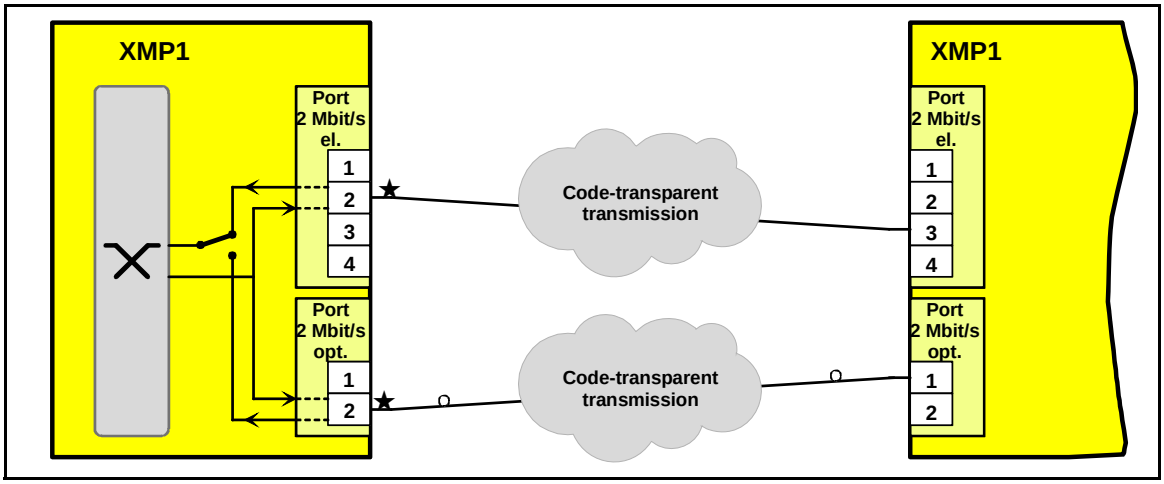


Figure 2.34: Card protection switching

2.8 Central Unit Redundancy

In order to protect the node from failure due to a defective Central Unit, the XMP1 system offers the possibility to double the Central Unit.

With Central Unit redundancy, only one Central Unit is active at a time. In case of a fault, the system switches over to the passive Central Unit automatically and an alarm is generated.

Connection

Information exchange between the two Central Units takes place via their redundancy interface. All data and clock information necessary for communication is routed via the cable (ZT redundancy) interconnecting the two Central Units. The information on which Central Unit is active or passive is also transmitted via this cable.

A special Y-cable is available for connecting the Operator Terminal (Control Computer, MSP). The clock and ServiceOn XMP1 system are provided by a special cabling.
Please note the relevant descriptions.

Caution !
A certain procedure must be followed when you want to mount or extract one of the two Central Units. For further information, please refer to the description of the Central Units.

Requesting the redundancy status

Using the Online functions and the debugging commands it is possible to request the redundancy status. The latter is requested together with the system information (command "mc 40").

Besides other system information, the answer from the node also includes the status of the passive Central Unit as well as the alignment status of the configuration data and firmware.

2.9 Line Equipment for 2 Mbit/s Transmission Links

2.9.1 Line equipment for fiber-optic cables

If the 2 Mbit/s signals are to be routed via fiber-optic cables, Port LE2 OPT U modules must be provided.

The Port LE2 OPT U module offers two electrical equipment interfaces and two optical card slots which can be flexibly equipped with 1F and 2F modules.

The laser used on the modules fulfills Laser Class 1 conditions both in operation and in case of a fault.

Module 1F

The 1F module (62.7026.580.00-A001 and 62.7026.580.00-A002) provides one 2 Mbit/s interface. Transmission in the Tx and Rx direction takes place via one single fiber using the wavelength-division multiplex procedure.

Module 2F

The 2F module (62.7026.570.00-A001 und 62.7026.540.00-A001) provides one 2 Mbit/s interface. With this module, transmission in the Tx and Rx direction takes place via separate fibers.

2.10 Signal Concentrator

In the XMP1 system, the signal concentrator module (62.7040.180.00-A001, AN00275454) provides interfaces (sensors and transmitters) to external units. This new module is generally referred to as "SIG II signal concentrator". It substitutes the signal concentrator module (62.7006.180.00-A001).

Using the sensors, messages received from external devices can be processed. In addition, such external devices can be controlled via the transmitters.

Possible signal sources:

- Alarm signals from external units with 7R signalling
- A-/B-/EL alarms
- ZA(A)/ZA(B) contacts
- Door contacts
- Fire detectors

The following devices can be controlled via the transmitters:

- Central alarm signalling unit
- Switching circuits triggered by alarms and messages

Extended alarm signalling

The signal concentrator can also be used for additional alarm signalling for XMP1 modules via signalling outputs. In this case, the module is displayed by the Operator Terminal under "EA ext. alarm signalling" modules. The signal concentrator can be assigned to another module and indicates the alarm status of the latter via relay contacts (transmitters).

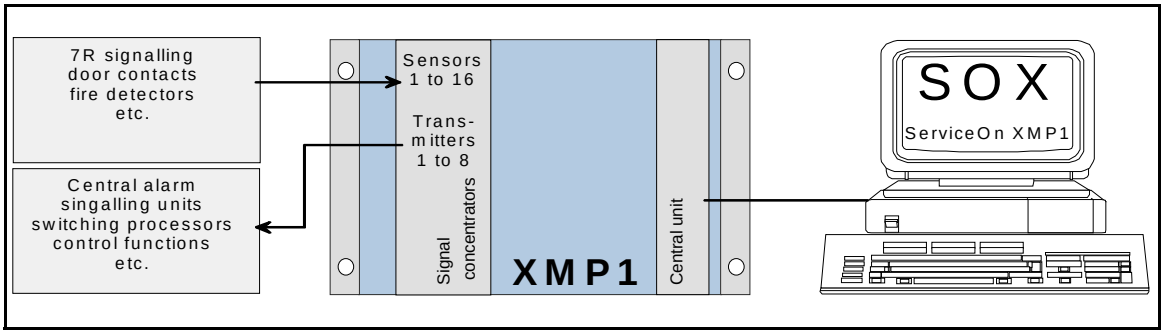


Figure 2.35: Signal concentrator

2.11 Performance Parameters of a Transmission Link

The performance criteria for the transmission of digital signals for different services and transmission links are defined by ITU-T Rec. G.821.

2 Mbit ports can be defined at which the performance parameters shall be determined on the basis of ITU-T Rec. 821. The SOX Network Manager requests and displays the parameters measured.

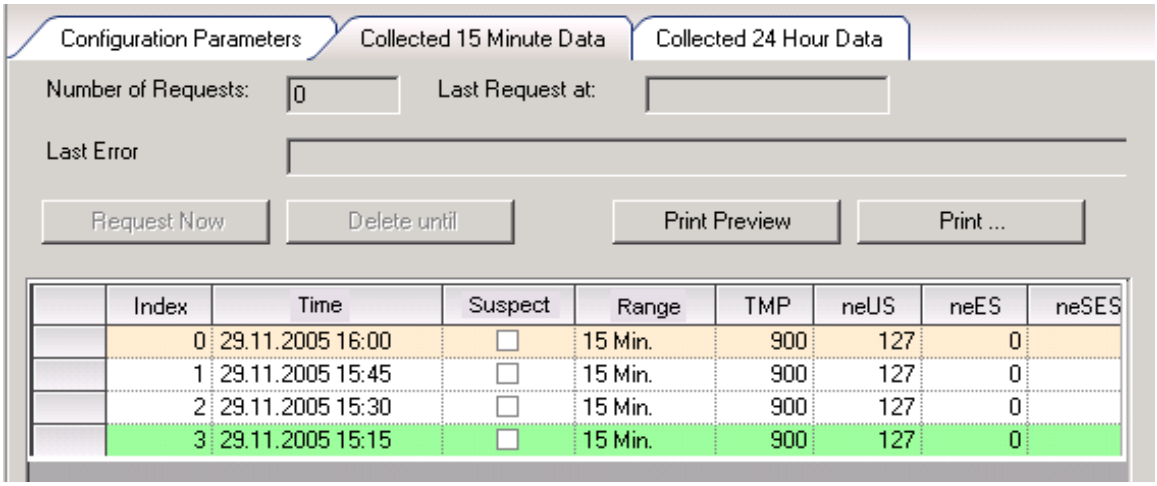
In the SOX Network Manager, the performance data can be configured and requested via the "Performance Data" window.

The performance data are stored in the database.

Performance data can be recorded for

- 2 Mbit/s PDH ports (HDB3, LEU, LE Opt)
- Central Unit CUE HDLC, VC12 (near end, far end)
- SCU internal 2Mbit E12 internal (near end)
- SCU internal 2Mbit E12 internal, VC12 (near end, far end)
- SCU external 2Mbit, PPI, D1, VC12 (near end)
- SCU OSPI, SFP, RS (near end)
- SCU OSPI, SFP, RS, MS (near end, far end)
- SCU OSPI, SFP, RS, MS, AU4 (near end)
- SCU OSPI, SFP, VC4 (near end, far end)

The following figure shows an example of the 15-minute records.



The entire time of a link is divided up as follows:

- time of availability
- time of unavailablity.

The time of availablity is subdivided again into the following performance levels:

- error-free operation

- degraded operation
- severely degraded operation.

The Central Unit of the node uses the number of bit errors counted to determine the bit error ratio and records the transmission quality during the entire measuring time in five performance levels depending on the bit error ratio:

- Error-free time
- Errored seconds
- Errored minutes (BER > 1×10^{-6})
- Severely errored seconds (BER > 1×10^{-3})
- Unavailable time (more than ten severely errored seconds in a row).

2.12 Switching Test Loops

For troubleshooting purposes, the operator can switch test loops on the modules listed below (A = analog loop D = digital loop).

Table 2.R: Test loops KZU, KZU II, DSK

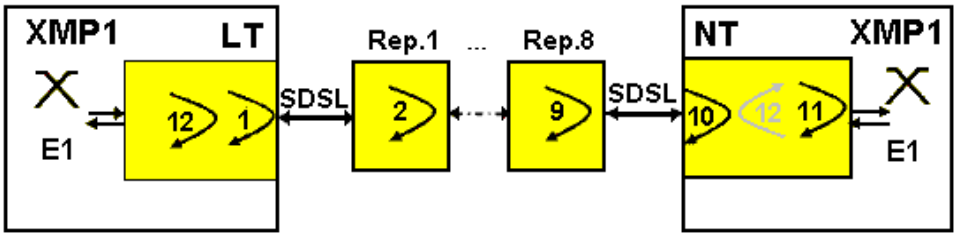
Loop no.	KZU				KZU II			DSK					DSK modular	
	FEK	SUB	EX	OSX	FEK	SUB	EX	64k	V24	X21	WT	V35	MDV	MDG
1	A	A	A	A	A	A	A	Internal loop (F1)	Loop 3c ITU V.54	Loop 3c ITU V.54	Loop 3c ITU V.54	Loop 3c ITU V.54	Loop 3 ITU V.54	Loop (D2)
2	D	D	D	D	D	D	D		Loop 2b ITU V.54	Loop 2b ITU V.54	Loop 2b ITU V.54	Loop 2b ITU V.54	Loop 2 ITU V.54	Remote loop
3												Switch-ing matrix loop; control line	Loop 3 and Loop 2	Near-end and remote loop
4														

Table 2.S: Test loops ISDN, Ports

Loop no.	ISDN				Port				
	UQF (4)	Uk0/Uk0F	S0F (4)	S0 / S0F	HDB3 LE	LE34 OPT	MUX34	LEU	LOU opt u.
1	B1&B2 w/o B* on both sides	B1&B2 w/o B* on both sides	B1&B2 w/o B* on both sides	B1&B2 w/o B* on both sides	Loop F1out-> F1in	F2 loop (coaxial)	Local loop (F1)	Loop F1out-> F1in	Loop F1out -> F1in
2	UK0 Loop	UK0 Loop	B1, B2 & B* unilateral	B1, B2 & B* unilateral		F1 Loop (optical)			
3	B1, B2 & B* on both sides	B1, B2 & B* on both sides	B1, B2 & B* on both sides	B1, B2 & B* on both sides					
4	External remote loop	External remote loop	External remote loop	External remote loop					

Table 2.T: Test loops SHDSL

Loop no.	SHDSL
1	LT SDSL loop NS direction
10	NT SDSL loop NS direction
11	NT E1 loop
12	Local E1 loop



For a detailed loop description, please refer to the relevant module description.

Chapter 3
SDH Expansion in the XMP1 System

3.1 Introduction

From the SDH view, the SDH expansion provides the following applications in the XMP1 system:

- STM-1/4 Terminal Multiplexer for 64 kbit/s connections up to STM-1 connections
- STM-1/4 Add/Drop Multiplexer for 64 kbit/s connections up to STM-1 connections
- Transparent transmission of 2 Mbit/s signals

XMP1 with SDH expansion is primarily used in networks with 64 kbit/s connections where line interfaces with STM-1/4 access are required.

3.1.1 Applications

Terminal Multiplexer
When used as Terminal Multiplexer, the XMP1 system provides one STM-1/4 Aggregate interface (or two with Dual Homing). The XMP1 PDH kernel offers 64 kbit/s switching options for up to eight E1 interfaces (internal interfaces). Also see Fig. 3.1.

Add/Drop Multiplexer
When configured as Add/Drop Multiplexer, the system can be used in single or double rings. In addition to the same scope of PDH switching options as provided by the Terminal Multiplexer, the system can offer SDH Tributary interfaces in single rings. Also see Fig. 3.1.

Transparent 2 Mbit/s transmission
The SDH expansion also supports a transparent transmission of internal and external 2 Mbit/s signals.

The following drawing shows the general application as Terminal and Add/Drop Multiplexer.

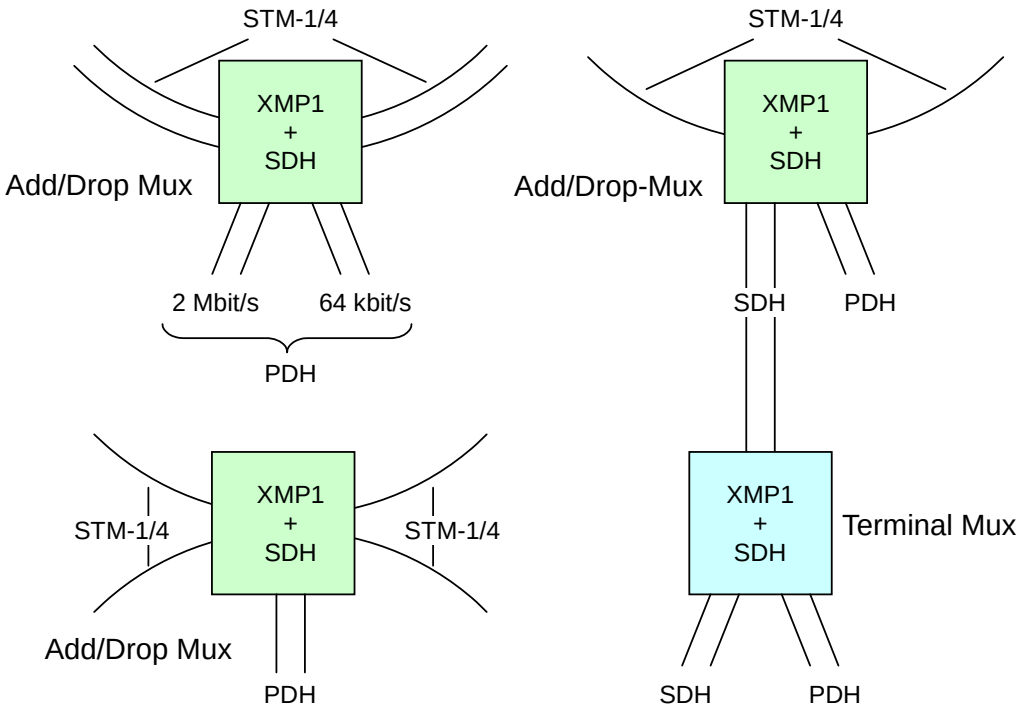


Figure 3.1: Application as Terminal or Add/Drop Multiplexer

3.2 Design of the SDH Expansion

The SDH expansion is implemented in the XMP1 system by means of the following modules:

- SCU (SDH Core Unit)
- CU-E (Central Unit Expansion)

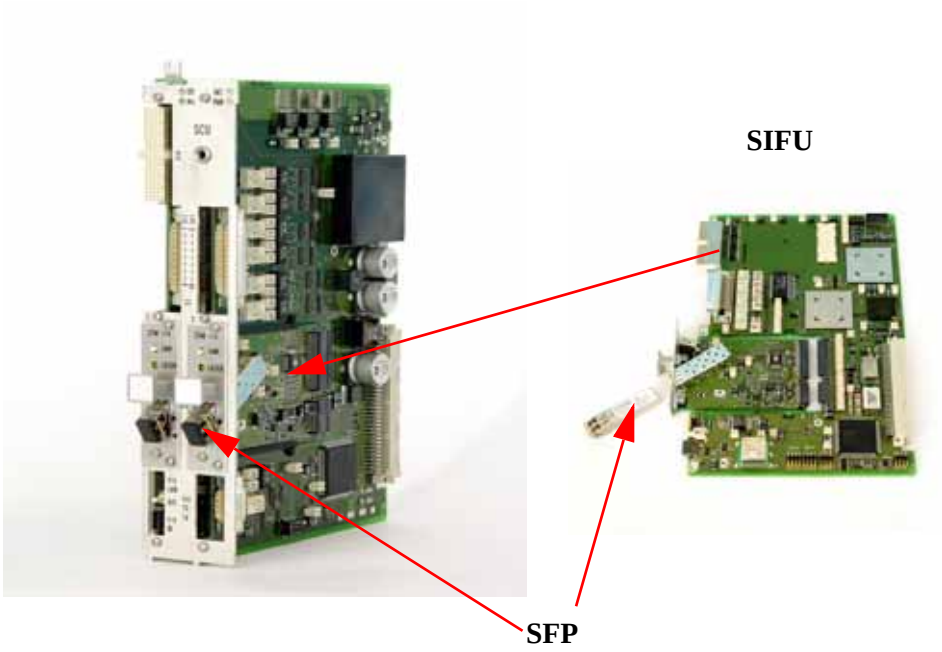
The SDH expansion of the XMP1 system is implemented on the **SCU** module. This module occupies two card slots in the XMP1 subrack. The **CU-E** sub-module is used as control module. It is mounted on the Central Unit (62.7040.xxx.xx) of the node.

SCU (SDH Core Unit)

The **SCU** (SDH Core Unit) module is composed of the **SCU-B** and **SCU-E** boards.

Each one of these boards can be equipped with an SDH Interface Unit **SIFU**. These are providing the STM-1/4 interfaces. SFP modules (Small Form Facture Pluggable Modules) are used for optical STM-1/4 interfaces and the electrical STM-1 interface. These SFP modules carry out the opto-electrical conversion of the interface signals. The optical fibers are connected via LC plug connectors. With the electrical STM-1 interface, the connection is set up using coaxial (straight) 1.0/2.3 plug connectors.

SDH Core Unit SCU



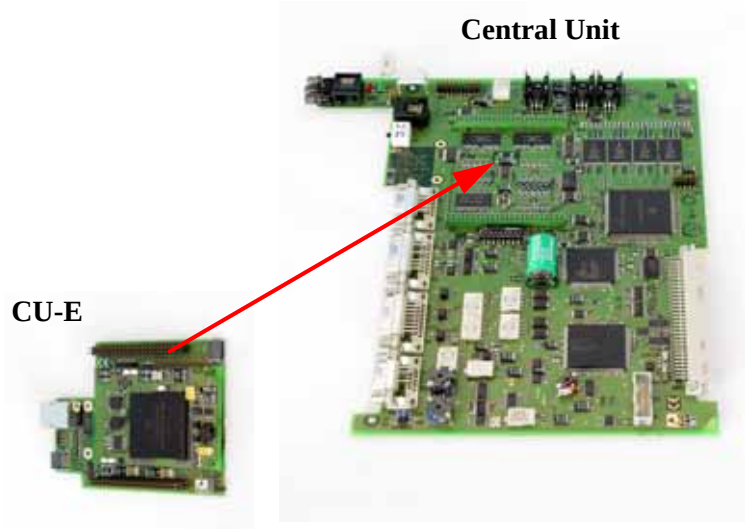
The **SCU-B** board includes the SCP ASIC (SDH Core Processor ASIC), the 2 Mbit/s Tributary ASIC (P12LPU), the interface to the XMP1 PDH system as well as a processor (PUC) for controlling the module. Furthermore, it provides a line interface as well as external and internal 2 Mbit/s interfaces.

A second **SCU-E** board provides an additional line interface as well as internal and external 2 Mbit/s interfaces. This board also includes the 60 V voltage converters required to generate the necessary operating voltages.

Module protection can be configured by means of a second SCU module. This second module is mounted in an adjacent card slot of the XMP1 subrack. The two SCU modules are interconnected by a common SCU-FP front panel.

CU-E (Central Unit Expansion)

The **CU-E** (Central Unit Expansion) sub-board is an expansion module for the Central Unit of the node. It provides the control functions and management interfaces to the SCUs (SDH Core Units).



3.3 SDH Functions

The SDH functions provided by the SDH expansion of the XMP1 system are made available by the SCP (SDH Core Processor). This SCP offers the line and cross-connect functions of an SDH multiplexer.

The following functions are provided by the SCP:

- 2 x SDH line interfaces (West/East), configurable for STM-1 or STM-4
- Overhead processing (SOH, HOVC, LOVC)
- Overhead interface to the OH bus (SOH, HOVC)
- 32 x STM-1 ports for non-blocking VC switching (VC-4, VC-3, VC-2, VC-12)
- SETG (Synchronous Equipment Timing Generator)

3.4 Interfaces

In the XMP1 system, the SDH expansion provides the following interfaces:

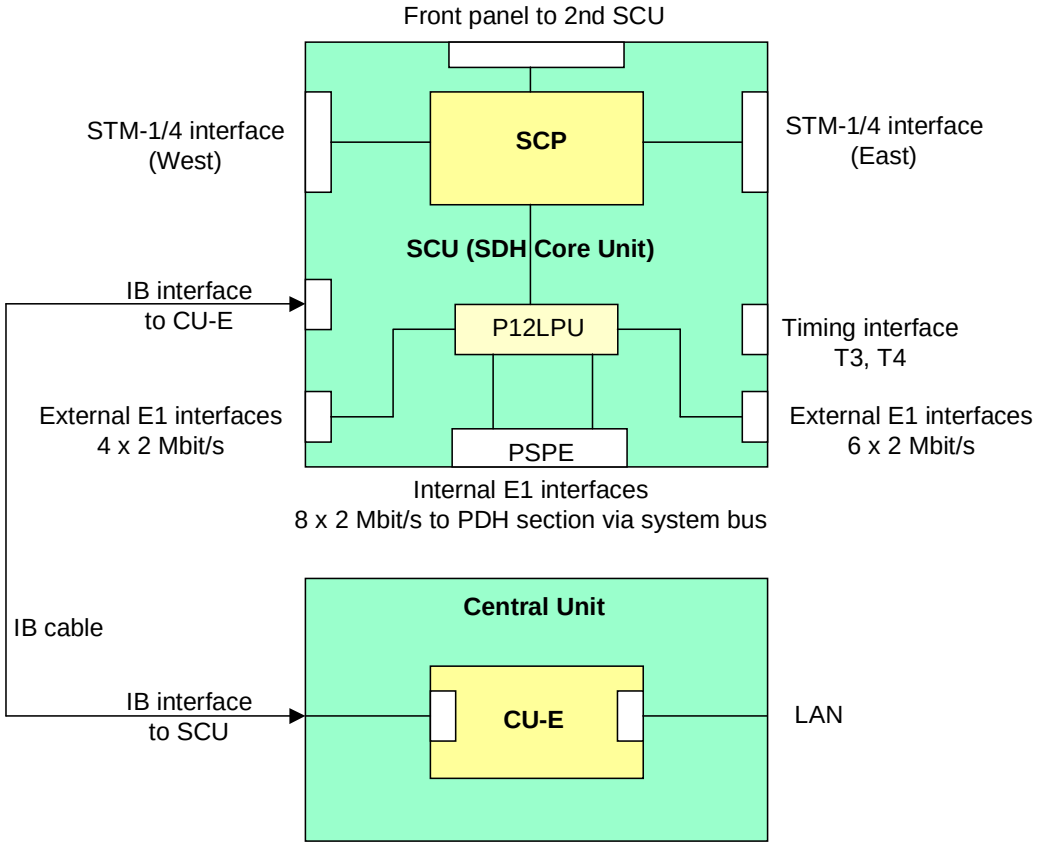


Figure 3.2: Interfaces of the SDH expansion

Optical STM-1/4 interfaces

The optical interfaces are made available by the SIFU (SDH Interface Unit) via SFP modules. Up to two such SIFUs can be mounted on one SCU module. A mixed equipment with both STM-1 and STM-4 modules and with optical and electrical modules is possible.

Connection is implemented using LC-type plug connectors.

The following SIFU modules are available for Release 5.1:

Tab. 3.A: Optical STM-1/4 interfaces

STM-1	
STM-1 S1.1 SH 1300	05HAM00088AAW
STM-1 L1.1 LH 1300	05HAM00089AAY
STM-1 L1.2 LH 1550	05HAM00090AAU
STM-4	
STM-4 S4.1 SH 1300	05HAM00091AAW
STM-4 L4.1 LH 1300	05HAM00092AAY
STM-4 L4.2 LH 1550	05HAM00093AAB

Application class syntax (acc. to ITU-T G.957):

The application class is described using the following syntax:

Application - STM level - Wavelength range
L 1 . 1

Application:
S: Short-haul,
distance up to about 15 km
L: Long-haul,
distance up to about 40 km with 1300 nm,
distance up to about 80 km with 1500 nm

STM level:
1: STM-1
4: STM-4

Wavelength range:
.1: Wavelength range: 1300 nm
.2: Wavelength range: 1500 nm

The lasers used for the optical interfaces meet Laser Class 1 conditions both in operation and in case of a fault. The lasers are maintenance-free.

Electrical STM-1 interfaces

The following SIFU modules will be provided:

- STM-1 EL 05HAM00107AAE with SFP electrical
- STM-1 Patch 2 m 05HAM00108ACR with patch cable 2 m

Tab. 3.B: Electrical STM-1 interfaces

STM-1 EL	05HAM00107AAE	with SFP electrical
STM-1 Patch 2 m	05HAM00108ACR	with patch cable 2 m

Connections are implemented using coaxial 1.0/2.3-type plug connectors.

E1 interfaces

The following interfaces are available for 2 Mbit/s signals:

- 8 x 2 Mbit/s to the XMP1 PDH kernel via the system bus
- 10 x 2 Mbit/s, 6 dB equipment interfaces (In-house) for the external connection of electrical 2 Mbit/s signals acc. to ITU-T G.703 (unstructured and structured acc. to ITU-T G.704).

Timing interfaces

The SCU module provides the timing interfaces T3 and T4. The T3 interface permits an external T3 clock of 2048 kHz to be connected. The impedance of this interface can be set to highly resistive, 120 Ohms or 75 Ohms.

The T4 timing interface supplies a 2048 kHz clock for synchronizing external units.

LAN (CU-E)

The LAN interface on the CU-E (Central Unit Expansion) is used to connect a network management system via a LAN infrastructure.

Internal bus (IB)

Communication between the SCU module and CU-E (Central Unit Expansion) sub-module mounted on the Central Unit takes place via the internal bus (IB).

3.5 Functioning

3.5.1 Switching interfaces

SDH
The SDH expansion provides the following interfaces for switching purposes:

- 2 STM-1 interfaces with 63 x 2 Mbit/s
- 2 STM-4 interfaces with 4 x 63 x 2 Mbit/s
- 10 external 2 Mbit/s interfaces
- 8 internal 2 Mbit/s interfaces to the PDH kernel

PDH
The PDH kernel provides the XMP1 interfaces already known.

3.5.1.1 Switching matrices

The following switching matrices are used for switching the signals applied to the interfaces:

- AU4 switching matrix
- TU3 switching matrix
- TU12 switching matrix
- BPX64 switching matrix

AU4 switching matrix
To set up lower-order connections, the AU-4 signal must be disassembled to a VC-4 signal. This is possible by establishing a bidirectional higher-order connection from AU-4 to VC-4. This connection is no connection in the usual sense, but represents a tool for disasssembling the AU-4 signal into its sub-structures.

LPXVC3 switching matrix
The LPXVC3 switching matrix is used to switch VC3 containers between HOA <--> HOA.

LPXVC12 switching matrix
The LPXVC12 switching matrix is used to switch VC12 containers of function units LOI 2M, LO2M and HOA.

The external 2 Mbit/s signals are applied via the LPXVC12 switching matrix to the TU-12s of the HOA.

BPX64 switching matrix
The BPX64 switching matrix is used to apply the 64 kbit/s signals from the PDH kernel to function group IPMB64/2.

3.5.1.2 Multiplex structure

Mapping

The SDH expansion uses a subset of the multiplex structure as defined in ITU-T G.707. The diagram below shows the multiplex structure used in the SDH expansion.

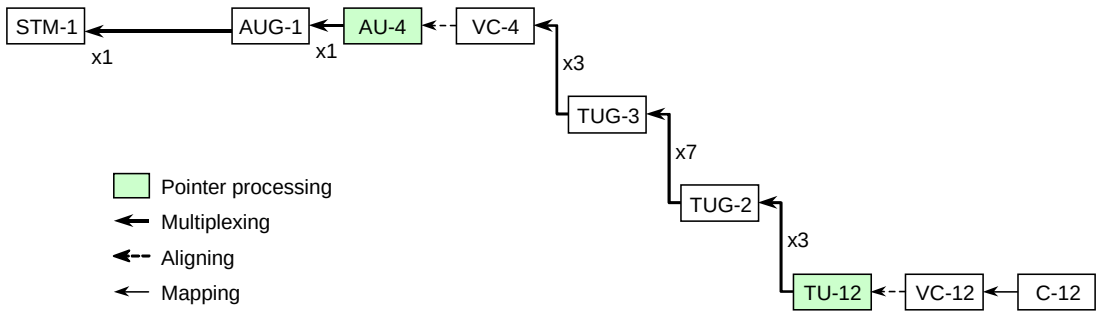
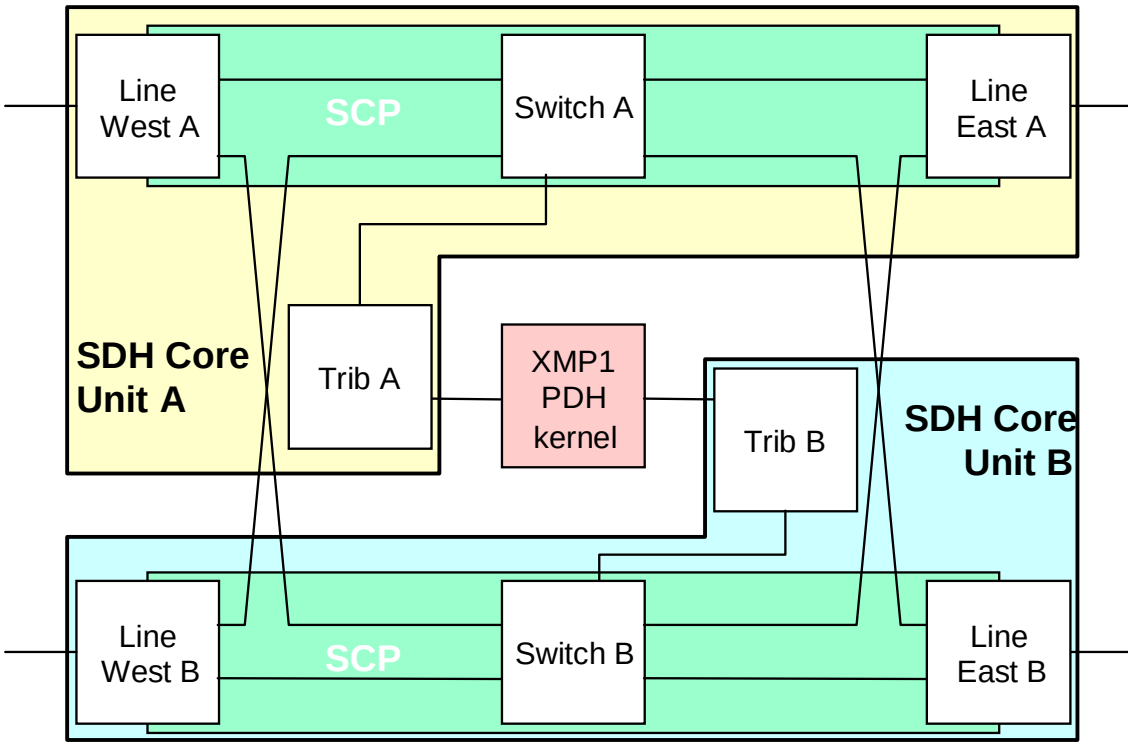


Figure 3.3: Multiplex structure of SDH expansion

3.5.2 Traffic architecture

The SDH expansion is primarily based on the functions of the SDH Core Processor SCP which provides the functions for data processing and switching.

The following diagram gives an overview of the traffic architecture and the connections between two SCUs and the XMP1 PDH kernel.



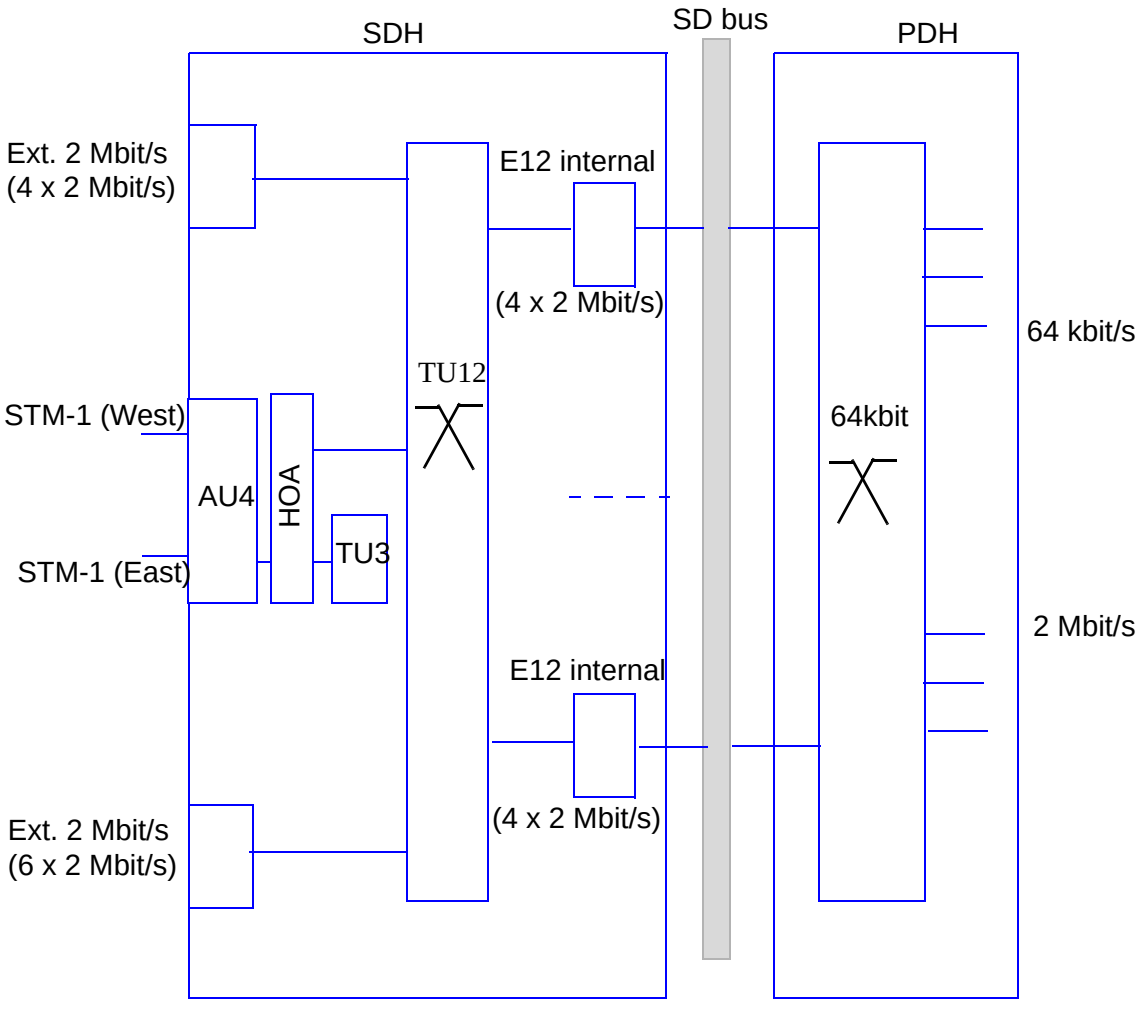
Connections between the SDH section and PDH kernel

The SDH expansion provides the STM-1/4 interfaces and 10 x 2 Mbit/s interfaces for the connection of external 2 Mbit/s signals.

In the PDH kernel direction, there are eight 2 Mbit/s interfaces for switching purposes.

The 64kbit/s switching matrix is used to apply the data of the PDH kernel to the internal 2 Mbit/s interfaces (E12 internal) of the SDH expansion. Then the corresponding VC12 is switched via the TU12 switching matrix in the STM-1 or 2 Mbit/s direction (external).

The following drawing shows the switching matrices used and the resulting switching options between the SDH expansion and XMP1 PDH kernel.



3.6 Clock Supply

For their internal switching process, the network elements included in an SDH network require a highly precise and stable clock (2048 kHz) which must be recovered from a reference timing source (Primary Reference Clock PRC).

The SDH expansion in the XMP1 system provides a SETS functionality according to EN 300 417-6-1 (Synchronization Layer).

The SDH expansion can recover its clock from one of the following reference timing sources:

- the clock of an STM-N signal received (T1: STM-N port, SCU module),
- the clock of a 2 Mbit/s signal received (T2: plesiochronous port, SCU module, ext. 2 Mbit/s interface),
- the synchronous network clock signal applied to the T3 interface,
- the internal clock generated by a local oscillator.

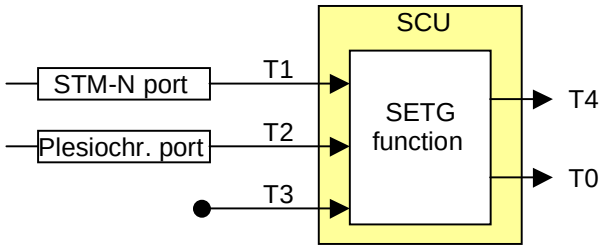


Figure 3.5: Synchronous Equipment Timing SETG

Irrespective of the clock quality, clock selection can take place using the associated priorities in both the revertive and non-revertive mode. The STM-1 line interfaces are supporting the SSM functionality.

A retiming function is possible for external 2 Mbit/s signals.

3.6.1 Synchronous Equipment Timing Source SETS

In the Synchronous Digital Hierarchy, the clock generator is referred to as SETS (Synchronous Equipment Timing Source). In the XMP1 system, the SETS of the SDH expansion is located on the SCU module.

It provides the following features and functions:

- Clock generation and clock recovery according to G.813.
- When doubling the SCU module, the SETS is available redundantly (1+1 Protection, both SETS active).
- All reference timing sources are monitored (the failure or return of a clock is signalled to the controller; in case of a failure of the active reference timing source, it will switch over to a standby timing source). Regarding the monitoring function and resulting measures, the SETS distinguishes between transmission defects and clock defects.
- Transmission of alarms and status messages to the Network Management System or Operator Terminal.
- Operating modes of the clock generator (SETS):
  - Tracking mode (synchronization to an external reference signal)
  - Holdover mode (if reference clock is too bad)
  - Free-run mode (startup mode).

3.6.2 Synchronous Status Message SSM

To permit easy automatic protection switching, the SETS of the SDH expansion supports the use of the Synchronization Status Message SSM. The SSM indicates the quality of the timing source used as basis for a certain signal.

In case of STM-N signals, the Synchronization Status Message SSM is transmitted in the S1 byte of the Section Overhead (SOH). S1 byte transmission can be switched off.
The SSM can assume the values indicated in the following table.

Table 3.C: SSM values specifying the clock quality

SOH BYTE S1, BIT 5 TO 8	CLOCK QUALITY OF THE SELECTED REFERENCE CLOCK
0000	Quality unknown
0010	Clock source: G.811 / PRC
0100	Clock source: G.812 transit
1000	Clock source: G.812 local
1011	Clock source: G.813 / SETS
1111	“Don´t use for sync”

In addition, it is also possible to permanently assign a certain SSM value to incoming STM-N signals configured as reference timing source, irrespective of the SSM value supplied with these signals.

The SSM value of outgoing STM-N signals can be set to 1111 (“Don´t use for sync”) manually. Otherwise these signals will be assigned the SSM value of the current clock quality of the internal T0 clock.

In case of plesiochronous signals, a SSM value is not transmitted. However, for incoming plesiochronous signals configured as T2 reference timing source , the operator can enter a SSM value and thus define the quality manually. The same applies to the T3 clock which can be applied to the external clock input.

In addition, each reference timing source can be assigned any priority between 0 and 7: “0” means high priority, whereas “7” means low priority.

For all types of reference timing sources, the priority is assigned manually by the user. This applies also to STM-N signals. The priority regarding the use of T0 (internal system clock) and T4 (clock output) can be adjusted separately.

The SETS selects the reference clock to be used according to the highest clock quality (SSM). In case of identical quality, the higher priority determines as to which reference clock will be selected.

3.6.3 SCU redundancy

The SETG functionality is doubled with the use of a second SCU module. The active SCU then provides the SETG Master function and supplies the internal system clock (for the SDH section) and T4 clock signal. The T4 clock signal can be selected using certain quality criteria.

The T1 timing sources of the active SCU (Master) are applied to the second SCU (Slave).

The external timing interfaces T3 and T4 of the SCUs are connected via Y-cables.

The following diagram shows the clock structure of the SCU.

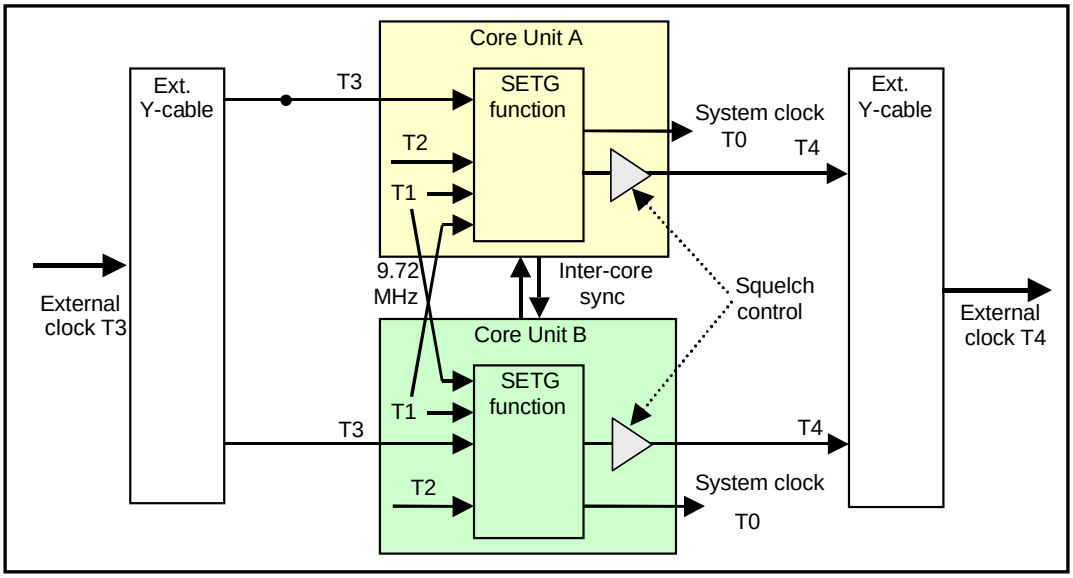


Figure 3.6: Clock with SCU redundancy

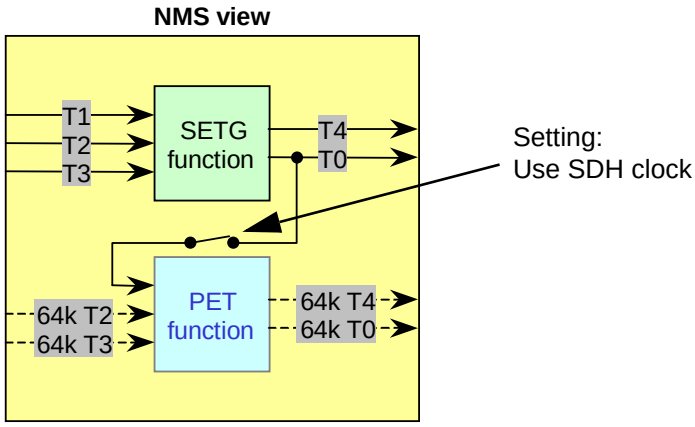
3.6.4 Clock supplied to the XMP1 PDH kernel

The SETG function of the SCU provides the SDH system clock T0, but not the PDH system clock (for the XMP1 Central Unit).

From the network management view, the different hardware parts of the SDH-based SETG and the PDH variant PET are not visible. The NMS only displays the SETG.

However, it is possible to apply the SDH system clock T0 to the PET function. In this case, the SDH system clock T0 can be used by the PET function for clock selection.
This setting is made in the SOX via sub-address 1 of the Central Unit using the Properties -> SDH Clock menu item and the "Use SDH clock" setting. The default setting of the system does not provide the use of the SDH clock for the PET function.

The following diagram shows the interaction between SETG and PET from the network management view.



If you want the clock network of the PDH network to remain independent, do not select the "Use SDH clock" setting. The PDH clock selection will then be independent of the SDH system clock T0. In this case, the current status of PDH clock selection will not be visible in the SOA.

Since the T3 and T4 status of the XMP1 PDH section is not visible in the SOA, it is necessary for an XMP1 with SDH expansion to relocate the external clocks T3 and T4 from the Central Unit to the SCU. This also improves the clock quality, because the PLLs of the SDH expansion provide a higher quality. In this case, the clock lines must be connected to X22 of the SCU module.

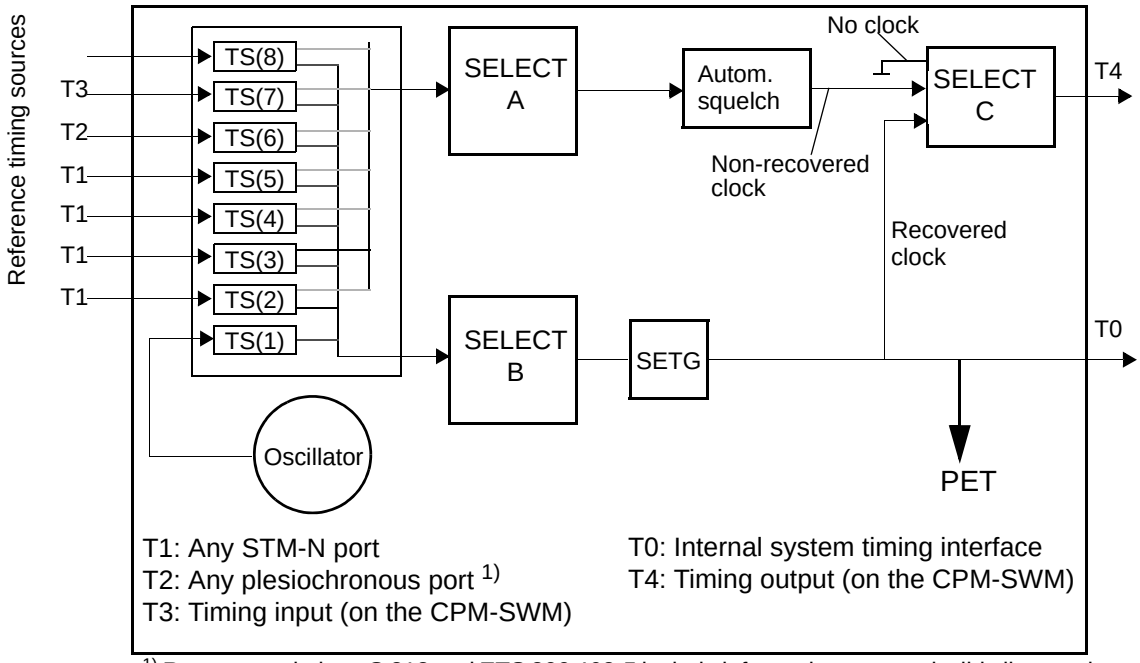
3.6.5 Clocks T3 and T4

The timing interfaces T3 and T4 are implemented on the 9-pin Sub-D connector X22 (male). This connector is located on the front side of the SCU module.

The impedance of the T3 interface can be set to highly resistive (>1.6 kOhms), 120 Ohms or 75 Ohms.

3.6.6 Functioning of the SETS

The following diagram explains the functioning of the SETS in the SDH expansion.



1) Recommendations G.813 and ETS 300 462-5 include information on permissible jitter and wander values. Due to their TU-12 pointer jitter, non-recovered 2 Mbit/s signals from SDH networks must not be used as timing sources for downstream networks.

Figure 3.7: SETS in the XMP1 SDH expansion

The SETS has eight configurable timing sources TS (1) to TS (8), i.e. eight reference timing sources can be connected to the SETS. The reference timing sources T1, T2 and T3 can be applied to timing sources TS(2) to TS (8).

The following applies to the SDH expansion:

- The internal oscillator is permanently connected to TS (1) on a hardware basis.
- TS (2) to TS (5) are used for clock T1.
- TS (6) is used for PDH clock T2.
- TS (7) is used for clock T3.

Selector switches SELECT A and SELECT B select one of the reference timing sources via the clock sources. The priorities for these switches can be adjusted at the Operator Terminal.

The reference clock made available at T4 can be recovered from reference timing sources TS (2) to TS (5).

The SETG (Synchronous Equipment Timing Generator) receives the clock from SELECT B and uses it to generate clock T0 required by the network element itself and made available to the modules.

SELECT A passes on the clock to the adjustable "Autom. squelch" switch. The latter decides whether the clock quality is sufficient and whether the clock will be switched through to selector switch SELECT C. SELECT C chooses the clock to be sent out at T4 (previously T3out). Both switches can be adjusted at the Operator Terminal.

Clock T0 can also be used for clock recovery in the PDH kernel. Clock T0 is then routed from SETG to PET of the PDH section. If one of the XMP1 nodes recovers its clock from the SDH clock, this clock will still be distributed in the network with priority 65535 via the 2MB ports of XMP1.

3.7 Protection

The reliability and maintenance of transmisssion networks are important aspects to be taken into consideration when using multiplexers. In this conjunction, redundancy configurations are playing a decisive role. The redundancy of both transmission channels and certain multiplexer modules is reasonable.

The SDH expansion in the XMP1 multiplexer supports the following protection types:

- Sub-Network Connection Protection SNCP 1+1
- Multiplex Section Protection MSP 1+1
- 2 Mbit/s protection (internal)
- Module protection

3.7.1 Traffic protection

3.7.1.1 SNCP Sub-Network Connection Protection

In SNCP configurations, the entire transmission path or individual path segments between the transmitter and receiver can be protected. Such a SNCP configuration can also cover several multiplexers.

In case of a failure of the operating path, the system switches over automatically to the protection path (standby path).

The following drawing shows the principle SNCP concept.

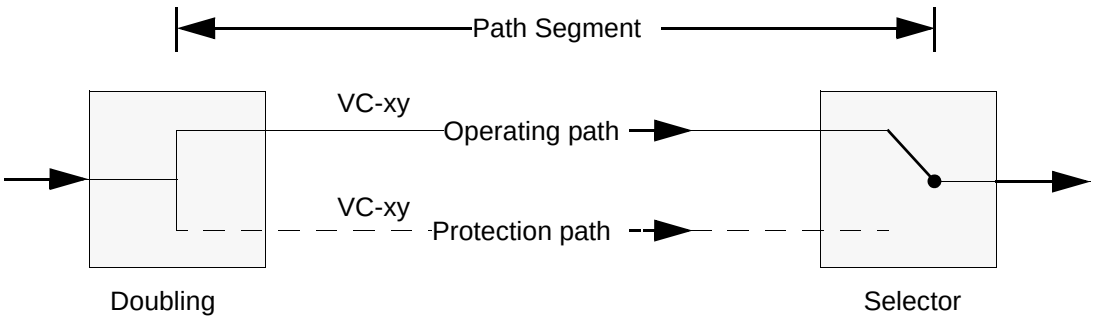


Figure 3.8: Principle of Sub-Network Connection Protection (SNCP)

The payload to be protected and available as **virtual container (VC)** is transmitted via two different interfaces and transmission paths to the receiver. In the receiver, both VCs are monitored and one of them will be selected.

The SDH expansion in the XMP1 supports the following SNCP types as defined by ITU-T G.841:

- SNC/I (inherent)
- SNC/N (non-intrusive)

SNCP can be configured for the following VC levels:

- VC-4,
- VC-3,
- VC-12.

SNCP features

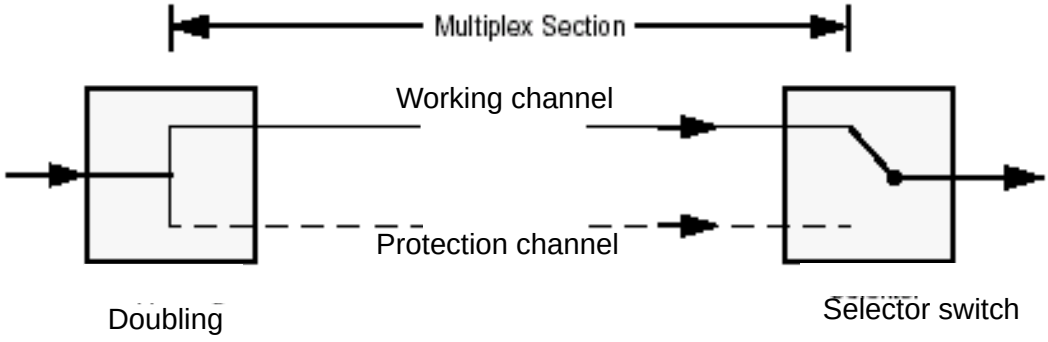
- Traffic signals are transmitted redundantly;
- SNC/I (inherent), SNC/N (non-intrusive);
- Single-ended switching (switchover takes place in the receiver only);
- Unidirectional/bidirectional;
- Non-revertive switching (no automatic reversion) or revertive switching (automatic reversion);
- Manual switchover;
- Switching criteria: Signal Fail SF, Signal Degrade SD;
- No extra traffic possible.

3.7.1.2 MSP Linear Multiplex Section Protection

With Multiplex Section Protection (MSP), the entire multiplex section between two multiplexers will be protected.
Transmission takes place both via the operating path and protection path. In case of a failure of the operating path, switchover to the protection path takes place automatically in the far end.

In the XMP1 unit, Multiplex Section Protection is used for the protected transmission via STM-N signals (of the SCU module).

A MSP can be configured for STM-N interfaces of on SCU module and for STM-N interfaces of different SCU modules.



The STM-N signal to be protected is doubled on the SCU module of the transmitter and send out via two line interfaces. On the SCU module of the receiver, a selector is used to select the operational transmission path.

MSP 1+1 features

- Single-ended, switchover in one MUX
- Dual-ended 1+1, switchover in both MUXs
- Revertive; reversion once the operating path has been restored
- Non-revertive, no reversion after the operating path has been restored
- No extra traffic possible

Switchover

Switchover between the operating path and protection path takes place in case of the following events:

- Line errors locally detected (SF and SD)
- Appropriate operator entries via the LCT or Element Manager:
  - Force switch traffic to working channel.
  - Force switch traffic to protection channel.
  - Manual switch traffic to working channel.
  - Manual switch traffic to protection channel.
  - Lockout of protection.

- A request received from the far end is executed either using the protocol in compliance with ITU-T G.841 or a proprietary K1/K2 protocol. These requests are valid only in the bi-directional mode. Requests include:
  - Lockout of protection
  - Force switch traffic to working channel
  - Force switch traffic to protection channel
  - Manual switch traffic to working channel
  - Manual switch traffic to protection channel
  - SF on operating path
  - SD on operating path
  - SF on protection path
  - SD on protection path
  - Wait to restore
  - Exercise
  - Reverse request
  - Do not revert
  - No request

Protocols for MSP switchover

Two different protocols can be used for MSP 1+1 control via K1- K2 bytes:

- the ITU-T G.841 protocol and
- a proprietary (accelerated) K1/K2 protocol with enhanced switchover behaviour.

MSP with one SDH module SCU

If an XMP1 node includes only one SCU module, MSP 1+1 can be configured as follows:

Example 1: see Fig. 3.9
- STM-N West: Working channel
- STM-N East: Protection channel

Example 2:
- STM-N West: Protection channel
- STM-N East: Working channel

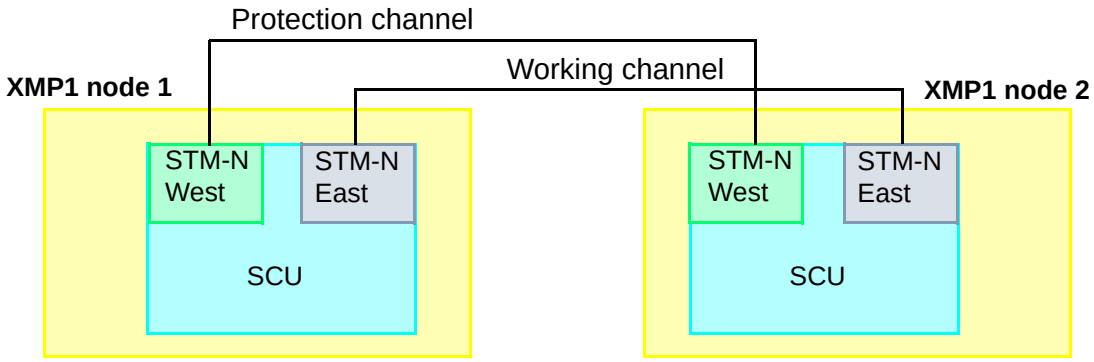


Figure 3.9: MSP 1+1 with one SCU module in the XMP1 node (example 1)

MSP with two SDH modules SCU in an XMP1 node

If an XMP1 node includes two SCU modules, MSP 1+1 can be configured between all STM-N interfaces of the modules available.

Example 1: see Fig. 3.10
SCU-A:
STM-N West: Working channel
SCU-B:
STM-N East: Protection channel

Example 2: see Fig. 3.11
SCU-A:
STM-N West: Protection channel
SCU-B:
STM-N West: Working channel

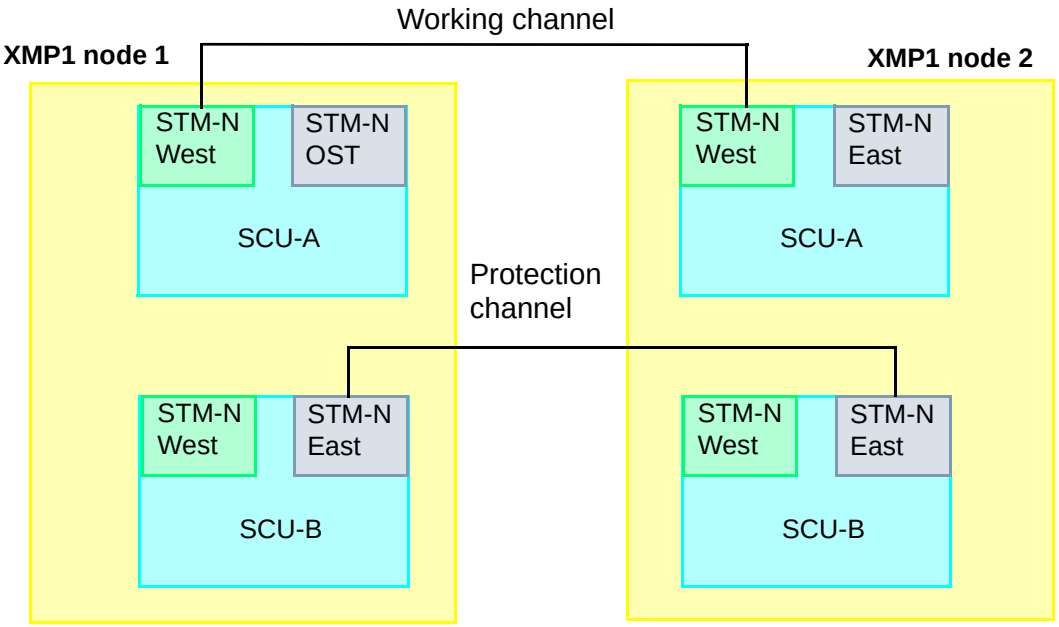


Figure 3.10: MSP 1+1 with two SCU modules in the XMP1 node (example 1)

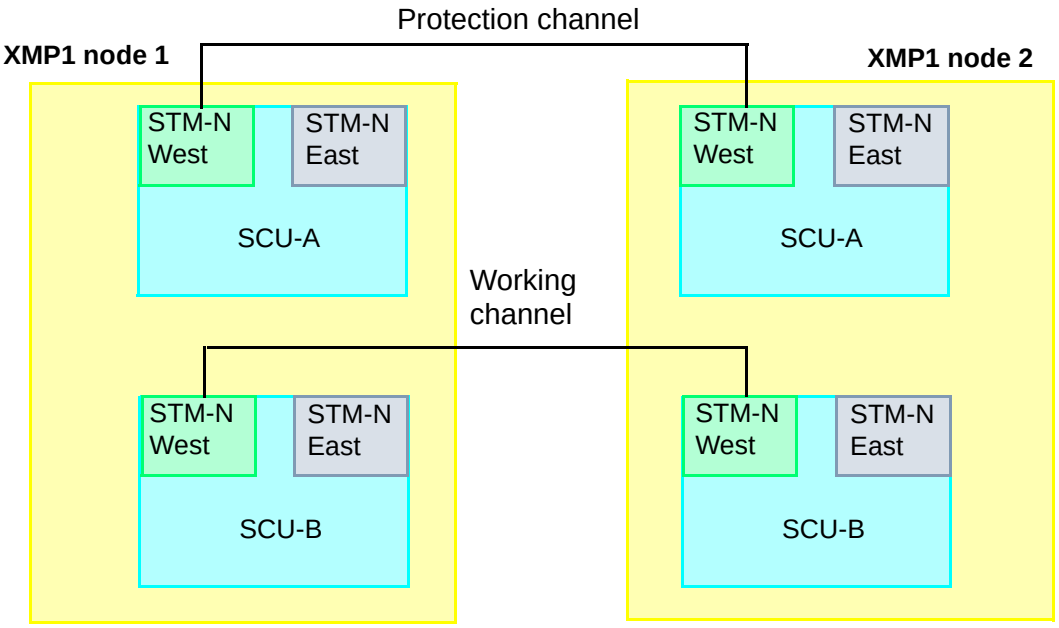


Figure 3.11: MSP 1+1 with two SCU module in the XMP1 node (example 2)

3.7.1.3 2 Mbit/s protection

Internal 2 Mbit/s ports

For internal 2 Mbit/s ports, the 2 Mbit/s protection options supported by the PDH kernel can be configured.

3.7.2 Module protection

3.7.2.1 SDH Core Unit Protection

The SDH Core Unit Protection is a SCU protection implemented at the equipment level. This protection covers the functions of the switching matrix and the synchronization functions of the SDH Core Unit. Since the SDH Core Unit also supports the connection of external 2 Mbit/s signals, these signals will also be protected by a SDH Core Unit Protection configuration. The 2 Mbit/s signals are routed and applied to the interfaces via Y-cables.

For such a protection configuration, two SCU modules are mounted in the XMP1 subrack in two contiguous card slots. These two SCU modules are interconnected by means of the SCU-FP front panel.

One SCU acts as Master, the other one as Slave.

The SDH Core Protection configuration is non-revertive, i.e. there will be no automatic reversion from the Protection SCU (Slave SCU) to the primary SCU (Master SCU) once the latter operates again correctly, e.g. after replacement of a faulty module.

3.7.2.2 CU-E Protection

The CU-E is mounted as sub-module on the Central Unit of the XMP1 node. The Central Unit in the XMP1 node can be doubled.

With Central Unit redundancy, the CU-E sub-module must be mounted on both Central Units.

In case of a Central Unit switchover, switchover also takes place from one CU-E sub-module to the other. Thus, it is ensured that an active CU-E is never on a passive Central Unit.

3.8 Management Functions

3.8.1 Fault Management

The Fault Management in the SDH expansion is executed in compliance with ITU-T G.784.

BW7R alarm signalling scheme

The BW7R alarm signalling scheme is processed on the Central Unit. The required alarm information from the SDH expansion is routed via the CU-E sub-module to the Central Unit and processed by the latter.

SDH alarms

See Section 6.8.1, *Alarm list* for SDH alarms.

3.8.2 Configuration Management

The Configuration Management covers the following functions:

- Connection Management
- Interface Configuration
- Clock Management

3.8.2.1 Connection Management

The Connection Management of the SDH expansion provides the following functions:

- Add connections
- Delete connections
- Modify connections

These connections can have the following attributes:

- Unidirectional or bidirectional connections
- VC type: VC-4/3/12 for STM-N interfaces, VC-12 for E1 interfaces
- Connection status: configured, activated
- Protection

3.8.2.2 Interface configuration

The different interfaces and their sepcial versions permit the following configuration options:

Optical SDH Physical Interface OSPI

- Activate/deactivate laser

- Test loop (port, switching matrix)

STM-1/4 Regenerator Section

- Trail trace identifier
- BER thresholds
- Switch through byte D, E, F

STM-1/4 Multiplex Section

- BER thresholds
- Switch through byte D, E
- Forced SSM

Higher Order Path

- Signal structure, signal label
- Trail trace identifier
- BER thresholds

2Mbit/s interfaces

- Interface modes (PCS, transparent)
- Retiming mode

Lower Order Path

- Mapping
- Signal label
- Trail trace identifier
- BER thresholds

3.8.2.3 Clock Management

The Clock Management deals with the configuration and behaviour of SETG functions. Its main tasks include:

- Configuration of timing sources (T1, T2, T3, internal oscillator)
- Quality of timing sources
- Priority of timing sources
- Clock selection criteria (quality, priority, error status)

For further information, please refer to Section 3.6, *Clock Supply* .

3.8.3 Software and Data Management

Application software

The application software of the SDH expansion running on the SCU module and CU-E sub-module must be considered separate from the XMP1 Central Unit software. It is stored in a FLASH memory on the CU-E sub-module.

This non-volatile memory is composed of two banks, i.e. an active and a passive bank. The application software is downloaded to the passive bank via the XMP1 Central Unit.
During the SCU startup process, the application software is loaded to the RAM of the SCU processor.

With Central Unit redundancy and thus CU-E sub-module redundancy, the application software of the CU-E is aligned between the active and passive Central Unit via the internal bus (IB).

SDH database

The SDH database is stored in a RAM located on the CU-E sub-module. From there it is saved to a battery-buffered flash bank of the Central Unit.

The SDH database can be uploaded and downloaded together with the PDH database. The data are downloaded always to the passive bank.

An alignment process between the active and passive CU-E ensures data consistency between the active and passive CU-E sub-module.

3.8.4 Equipment Management

The Equipment Management covers the modules and sub-modules of the SDH expansion.

These include:

- SCU
- SIFU (2)
- SFP (2), only for SFP-based SIFU

Main functions:

- Module detection
- RID (remote inventory data)
- In-service configuration changes
- Nominal/actual equipment
- Module insertion/extraction detection
- Module insertion or alarm signalling on extraction
- LED management

3.8.4.1 Remote inventory data (RID)

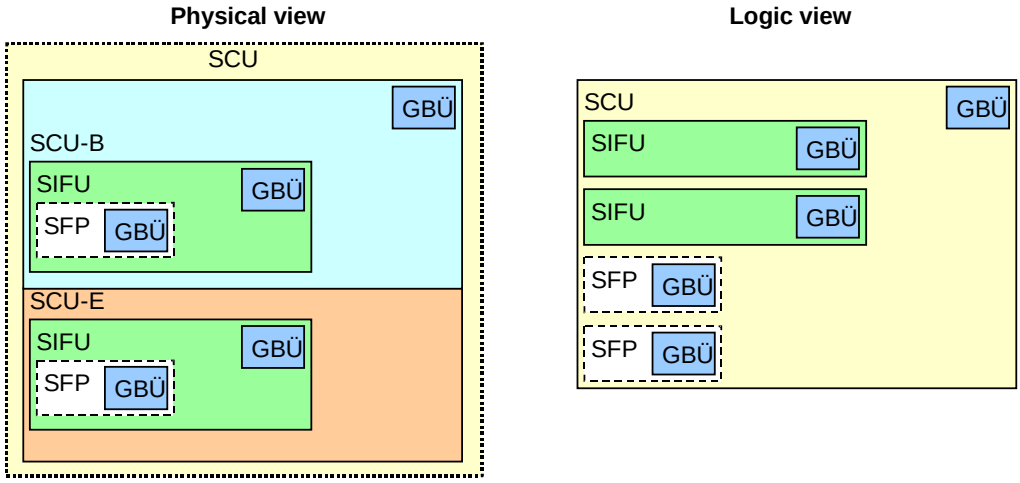
The RID data provide information on modules and sub-modules used in the SDH expansion. This information can be requested via the NMS.

RID data are available for:

- SCU module
- SIFU sub-module

- SFP module

The following drawing shows the physical and logic view of the modules and sub-modules with their RID data.



GBÜ = Remote Inventory Data (RID)

3.9 Network Management

The existing PDH functionality and additional SDH expansion are described in a common information model. The PDH and SDH functionality are treated as network element. The information model is based on the existing function units for SDH and PDH.

With release 5.0 and higher, the network management for the SDH expansion of XMP1 will be implemented using the ServiceOn XMP1 (SOX) Network Management System based on the information model. This permits an easy transition to the planned ServiceOn Access utilization.

3.9.1 ServiceOn XMP1

The ServiceOn XMP1 (SOX) Network Management System is the successor of the Control Computer previously used.

The ServiceOn XMP1 Network Management System is used to control, configure and monitor pure XMP1 networks.

PCs with the MS Windows Server 2003 ® operating system are used as management workstations. Besides the Element Manager, SOX also provides a Network Manager supporting 8 kbit/s, n x 64kbit/s and 2 Mbit/s switching options. With the SDH expansion, these will be extended by SDH switching options (VC12, VC3, VC4).

The following section gives a description of the information model.

3.9.2 Information model XMP1 with SDH expansion

Fig. 3.12 shows the information model of the XMP1 system, Release 5.2, with SDH and Ethernet expansion.

3.9.2.1 Function groups of the SDH expansion

The function groups are defined in the relevant SISA specification. Each function group is assigned a certain function group number.

The SDH/Ethernet expansion uses the following function groups of the information model.

Table 3.D: Function groups of the SDH/Ethernet expansion

FUNCTION GROUPS	MEANING	FG NO.
HOA	High Order Assembler	59
TTF-1	Terminal Transport Function STM-1	33
TTF-4	Terminal Transport Function STM-4 (optical)	35
RTF-4	Regenerator Transport Function STM-4	37
RTFE-1	Regenerator Transport Function electrical	39
RTF-1	Regenerator Transport Function STM-1	40

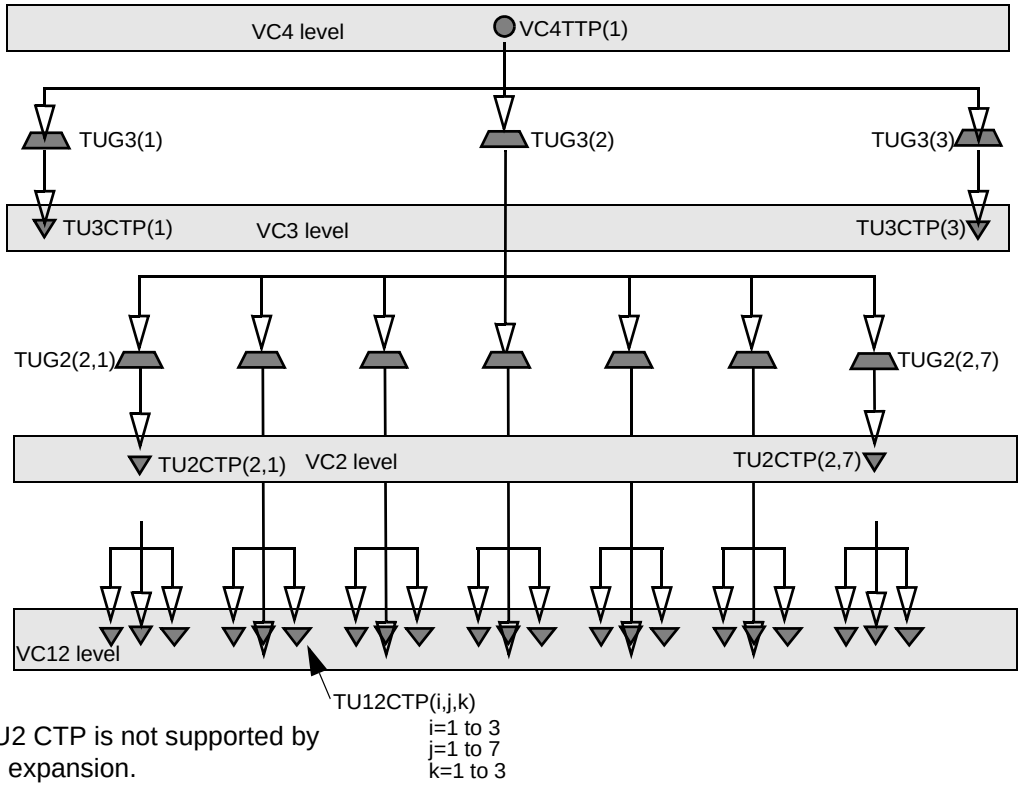
Table 3.D: Function groups of the SDH/Ethernet expansion

FUNCTION GROUPS	MEANING	FG NO.
MSPTF-1	Multiplex Section Protection Termination Function STM-1	47
MSPTF-4	Multiplex Section Protection Termination Function STM-4	48
HPX VC4	High Order Path Connection VC4, VC4 switching matrix	63
LPX VC3	Low Order Path Connection VC3, VC3 switching matrix	62
LPX VC12	Low Order Path Connection VC12, VC12 switching matrix	60
LOI 2M	Low Order Interface 2Mbit/s	45+46
SET2	Synchronous Equipment Timing	50
Eth-Port *	Ethernet Port	171, 172
Eth_VC3 *	Ethernet nX VC3 Mapper	178, 179
Eth_VC12 *	Ethernet nX VC12 Mapper	174, 175
* only Ethernet expansion		

HOA Higher Order Assembler

The HOA function scheme represents the multiplex structure. For each level (VC-4, VC-3, VC-2 and VC-12), the TP index is numbered serially starting from 1.

HOA function scheme



Note: TU2 CTP is not supported by the SDH expansion.

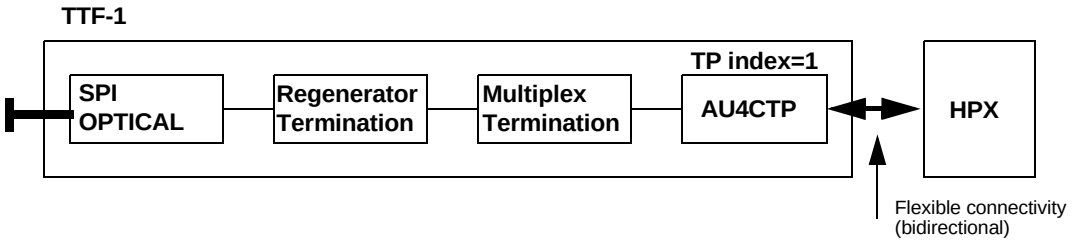
HOA application functions

Table 3.E: HOA application functions

Application functions	Spont. event	Request/Response	Command
Alarm information	X	X	-
Configuration	X	X	X
Operating status	X	X	X
User files	X	X	X
Reference list	-	X	-

TTF-1 Terminal Transport Function STM-1

The function group TTF-1 offers a synchronous optical STM-1 interface (SPI OPTICAL). On the AU4CTP side, flexible connections can be set up via the higher-order switching matrix HPX VC4.



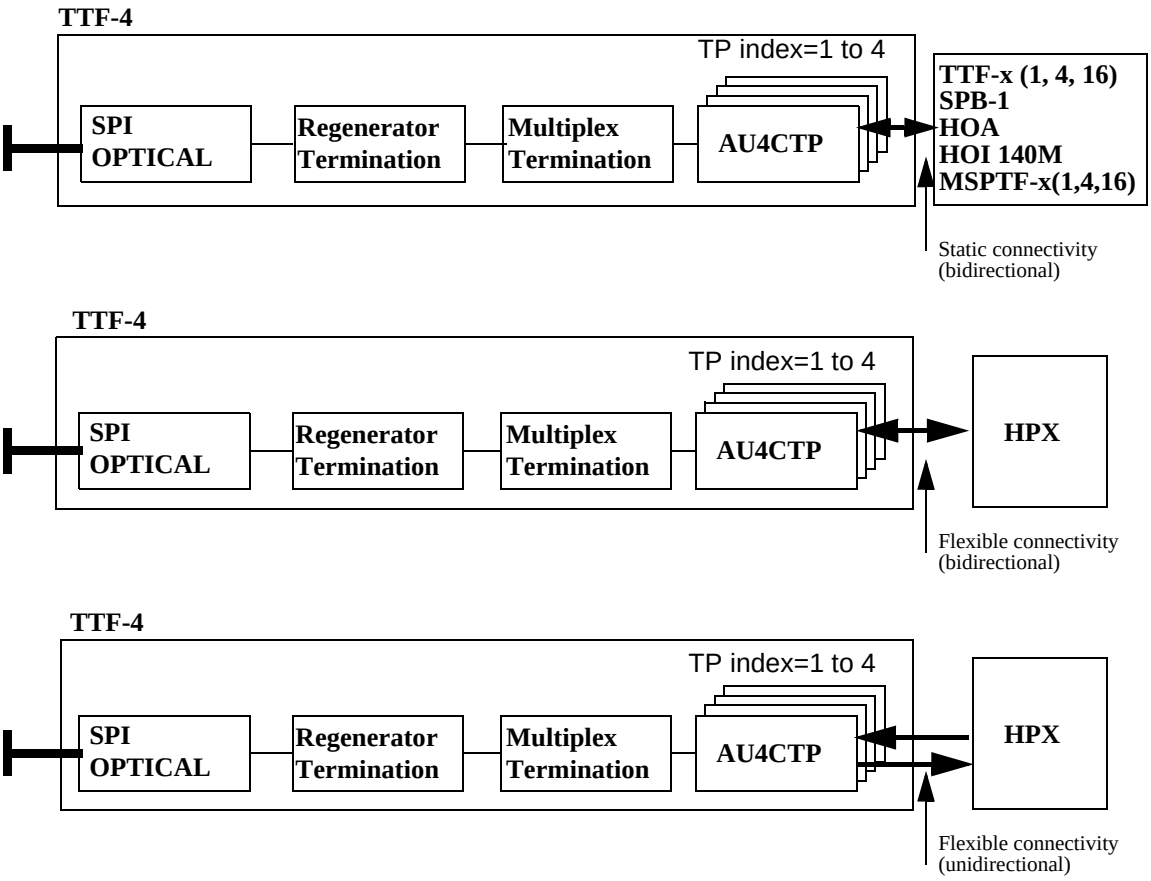
TTF-1 application functions

The following table gives an overview of the TTF-1 application functions.

Table 3.F: TTF-1 application functions

APPLICATION FUNCTIONS	SPONT. EVENT	REQU./RESP.	COMMAND
Alarm information	X	X	-
Configuration	X	X	X
Operating status	X	X	X
User files	X	X	X
Reference list	-	X	-

TTF-4 Terminal Transport Function STM-4



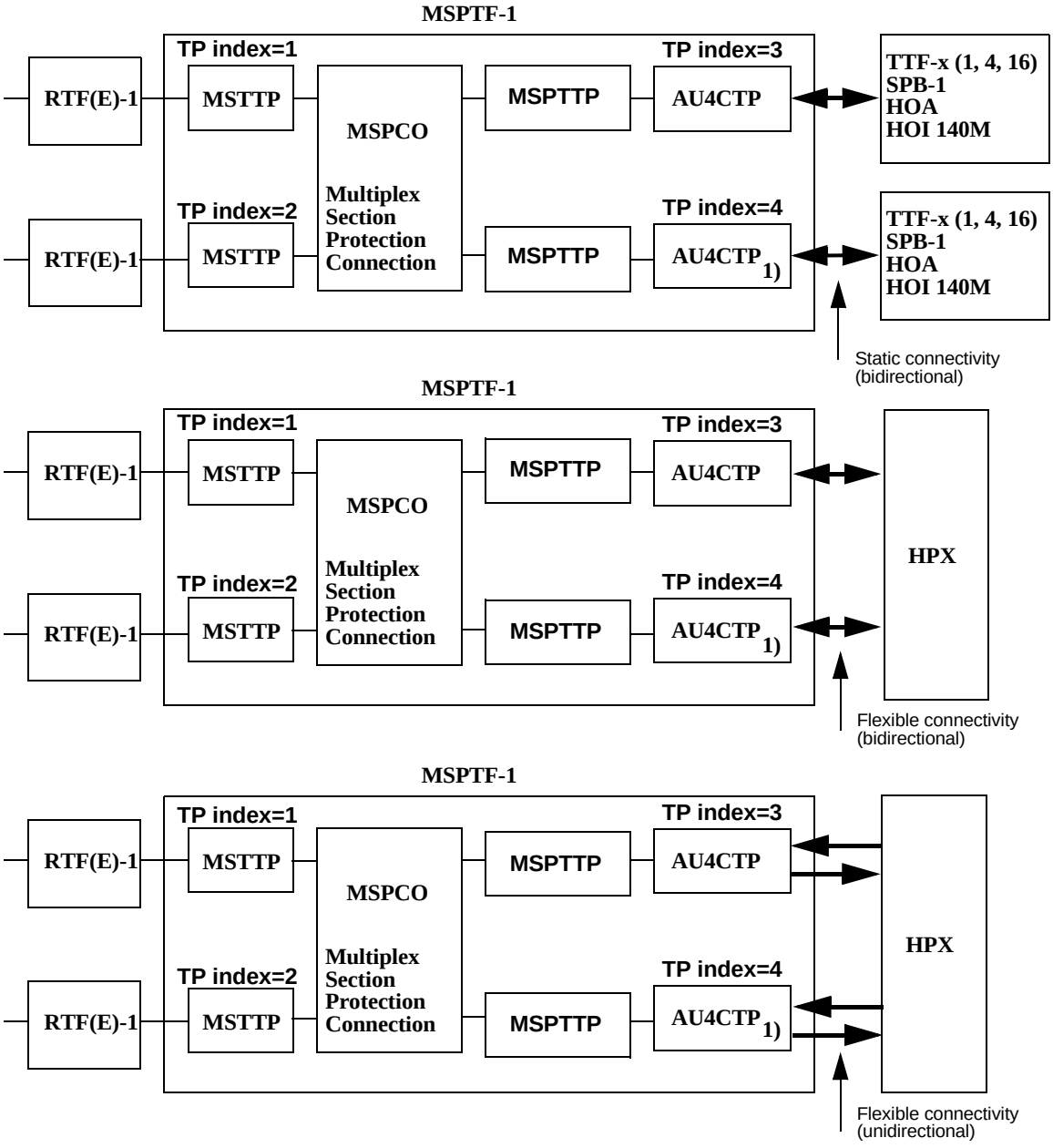
TTF-4 application functions

The following table gives an overview of the TTF-4 application functions.

Table 3.G: TTF-4 application functions

APPLICATION FUNCTIONS	SPONT. EVENT	REQU./RESP.	COMMAND
Alarm information	X	X	-
Alarm disabling and priority	X	X	X
Sampling parameters	X	X	X
Configuration	X	X	X
PM configuration	X	X	X
Performance data	-	X	-
PM address	X	X	-
Operating status	X	X	X
User files	X	X	X
Reference list	-	X	-

MSPTF-1 Multiplex Section Protection Termination Function STM-1



MSPTF-1 application functions

The following table gives an overview of the MSPTF-1 application functions.

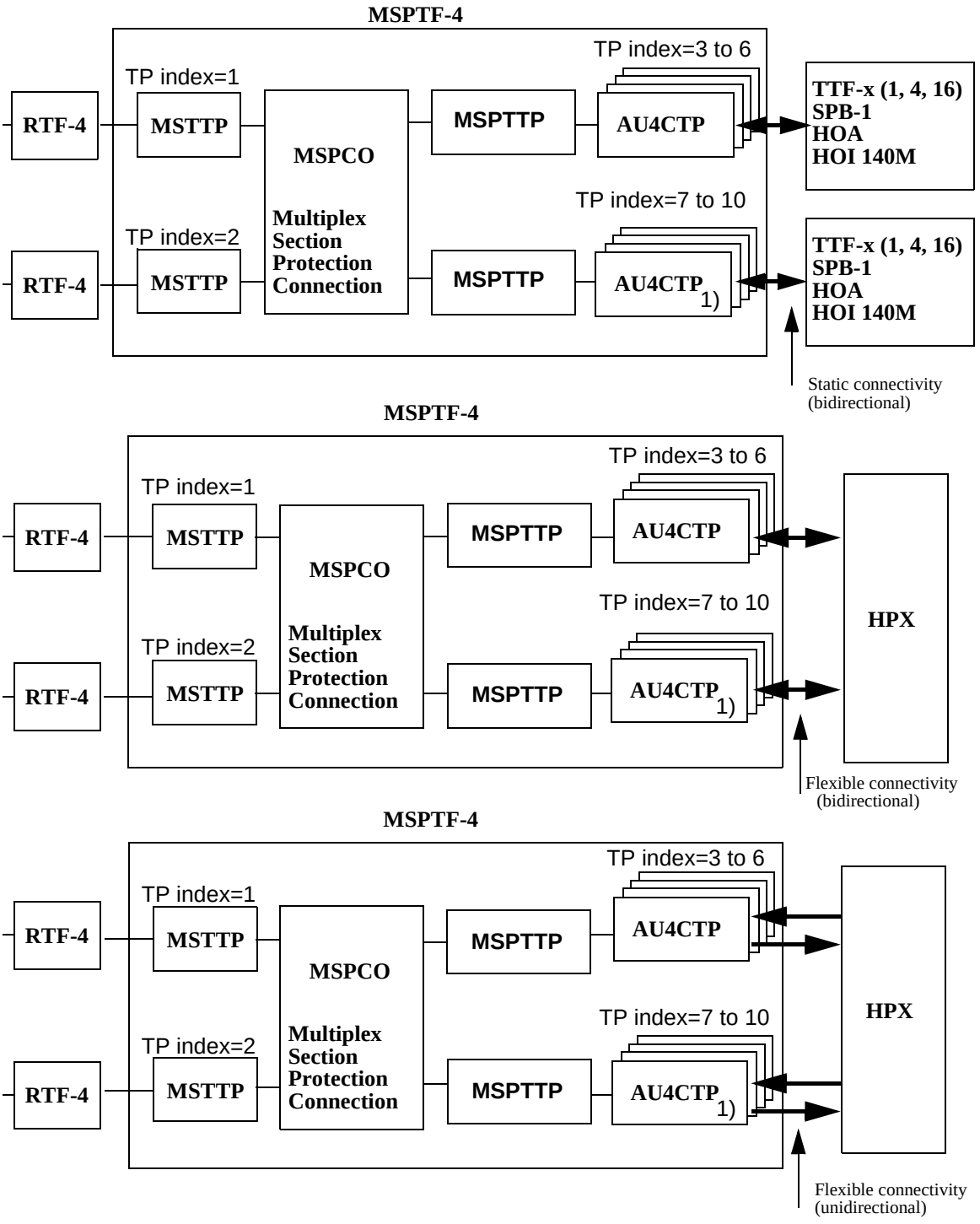
Table 3.H: MSPTF-1 application functions

APPLICATION FUNCTIONS	SPONT. EVENT	REQU./RESP.	COMMAND
Alarm information	X	X	-
Alarm disabling and priority	X	X	X
Sampling parameters	X	X	X
Configuration	X	X	X

Table 3.H: MSPTF-1 application functions

APPLICATION FUNCTIONS	SPONT. EVENT	REQU./RESP.	COMMAND
PM configuration	X	X	X
Performance data	-	X	-
PM address	X	X	-
Operating status	X	X	X
User files	X	X	X
Reference list	-	X	-

MSPTF-4 Multiplex Section Protection Termination Function STM-4



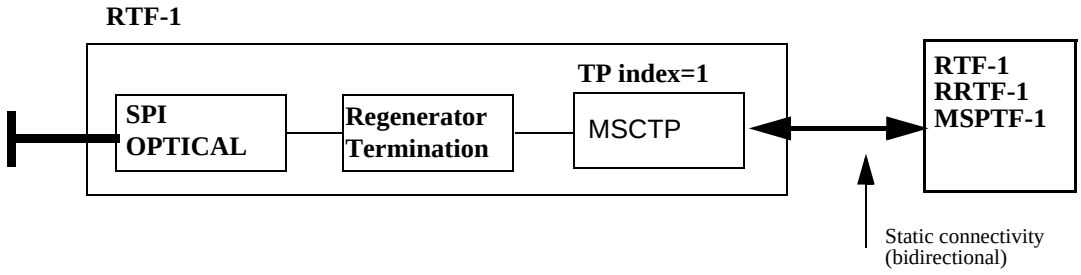
MSPTF-4 application functions

The following table gives an overview of the MSPTF-4 application functions.

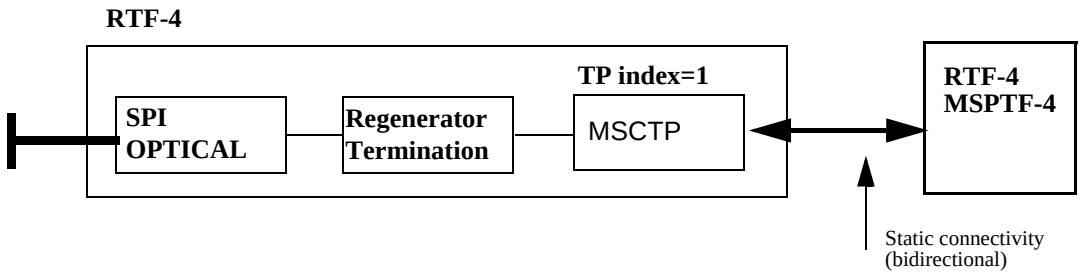
Table 3.I: MSPTF-4 application functions

APPLICATION FUNCTIONS	SPONT. EVENT	REQU./RESP.	COMMAND
Alarm information	X	X	-
Alarm disabling and priority	X	X	X
Sampling parameters	X	X	X
Configuration	X	X	X
PM configuration	X	X	X
Performance data	-	X	-
PM address	X	X	-
Operating status	X	X	X
User files	X	X	X
Reference list	-	X	-

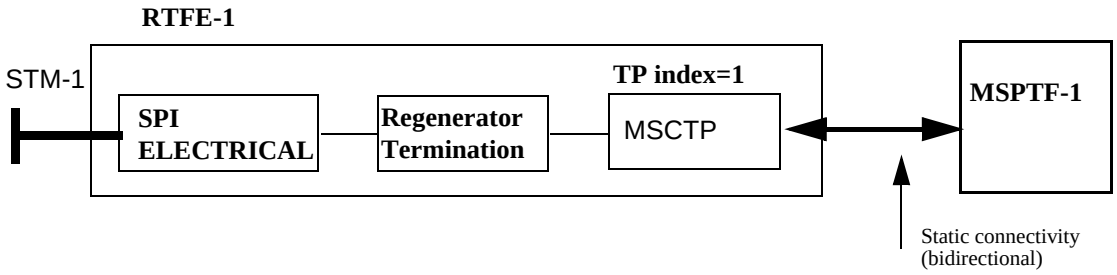
RTF-1 Regenerator Transport Function STM-1



RTF-4 Regenerator Transport Function STM-4



RTFE-1 Regenerator Transport Function Electrical STM-1



HPX, LPX

HPX VC4, LPX VC3 and LPX VC12 are switching matrices for different transmission rates. In principle, their behaviour is identical and a distinction is possible only by their function group numbers.

The following table shows the application functions of these switching matrices.

HPX, LPX application functions

Table 3.J: HPX, LPX application functions

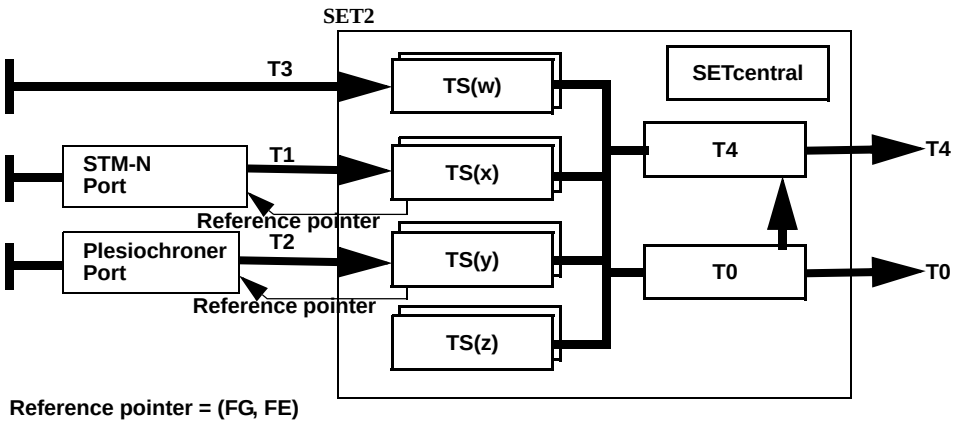
APPLICATION FUNCTIONS	SPONT. EVENT	REQU./RESP.	COMMAND
Alarm information	X	X	-
Configuration	X	X	X
Operating status	X	X	X
Reference list	-	X	-
Compliance information	-	X	-

SET2 Synchronous Equipment Timing

The SETS has eight configurable timing sources TS (1) to TS (8), i.e. up to eight reference timing sources can be applied to SETS. The reference timing sources T1, T2 and T3 can be connected to timing sources TS(2) to TS (8).

The following applies to the SDH expansion:

- The internal oscillator is permanently connected to TS(1) on a hardware basis.
- TS (2) to TS (5) are used for clock T1.
- TS (6) is used for PDH clock T2.
- TS (7) is used for clock T3.



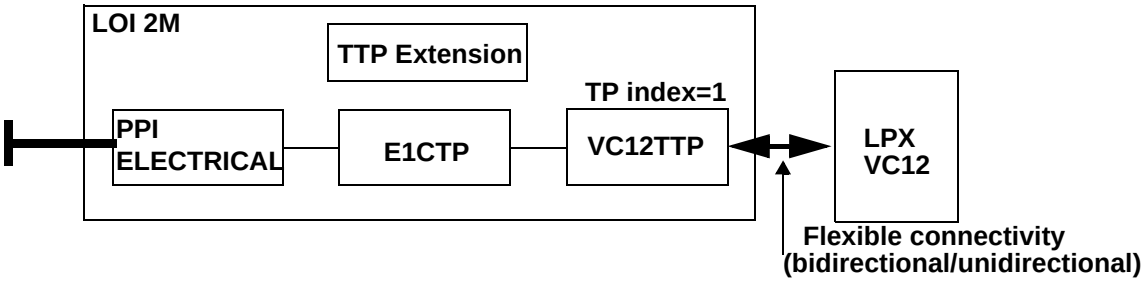
SET2 application functions

Table 3.K: SET2 application functions

APPLICATION FUNCTIONS	SPONT. EVENT	REQU./RESP.	COMMAND
Alarm information	X	X	-
Alarm disabling and priority	X	X	X
Configuration	X	X	X
Operating status	X	X	X
Reference list	-	X	-

LOI2M Lower Order Interface 2 Mbit/s

The function group LOI 2M offers a plesiochronous, electrical 2 Mbit/s interface (PPI ELECTRICAL). On the VC12TTP side, flexible connections can be set up via the lower-order switching matrix LPX VC12.
In the SDH expansion, the LOI 2M function group represents the external 2 Mbit/s interfaces.



LOI 2M application functions

Table 3.L: LOI 2M application functions

APPLICATION FUNCTIONS	SPONT. EVENT	REQU./RESP.	COMMAND
Alarm information	X	X	-
Configuration	X	X	X
Operating status	X	X	X
User files	X	X	X
Reference list	-	X	-

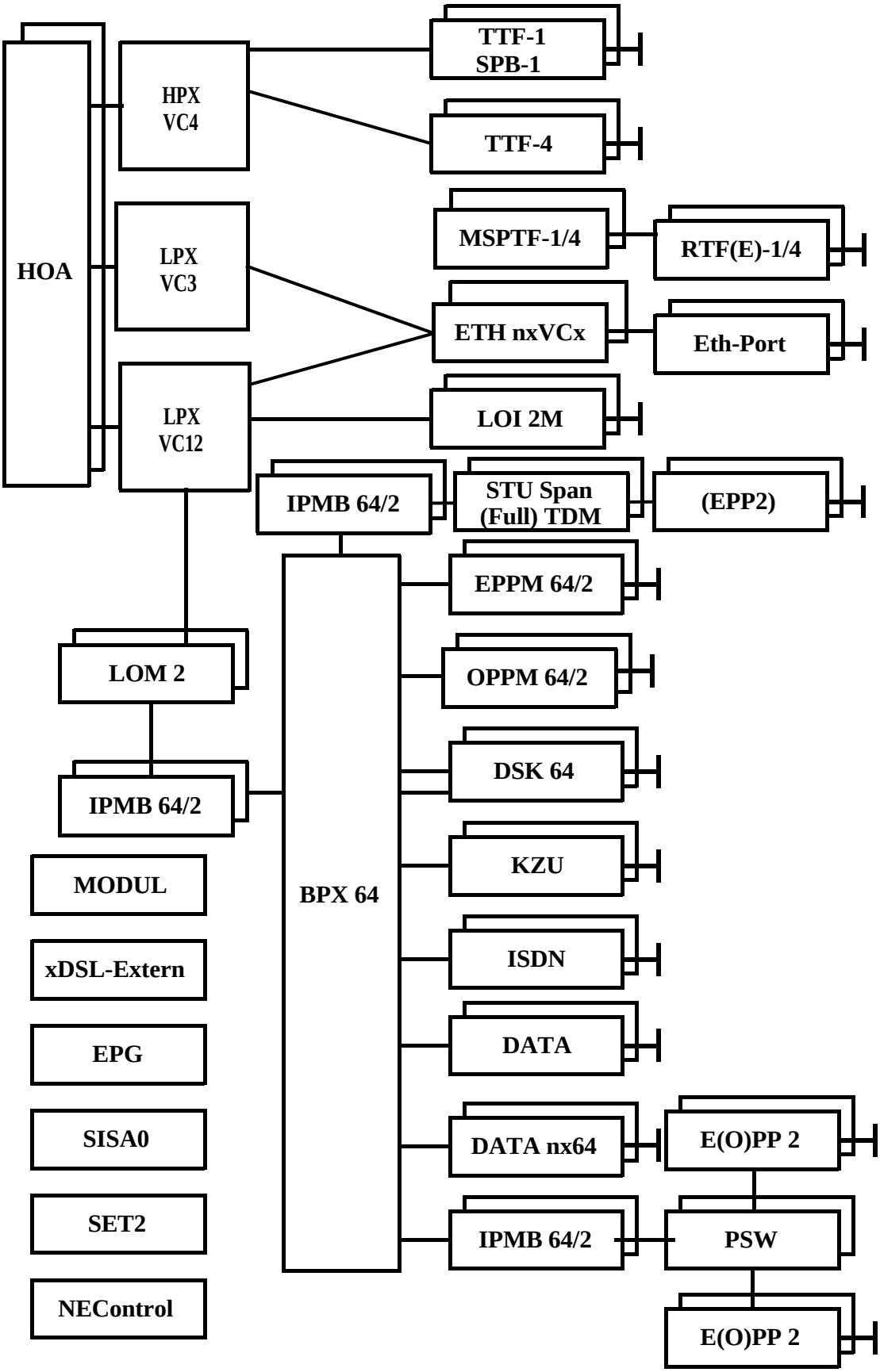


Figure 3.12: QD2 information model

3.10 Management Connection

3.10.1 Overhead information

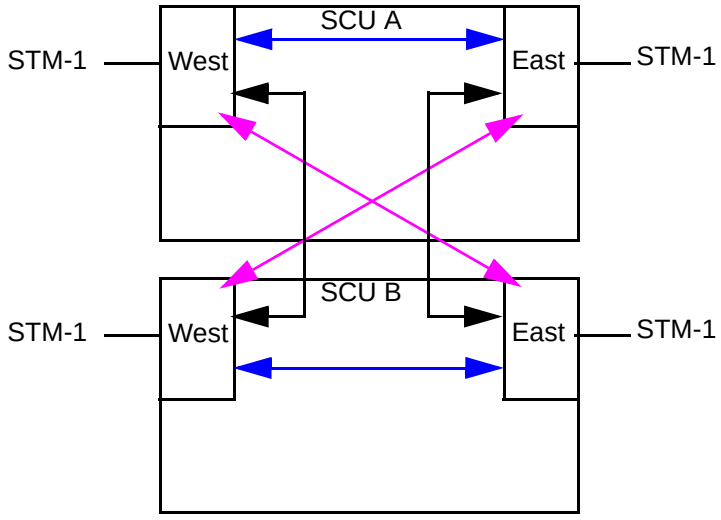
The **Section Overhead SOH** forms an STM-N frame together with the payload. This frame includes all information required for frame synchronization, service purposes, performance monitoring and other functions. The SOH is composed of a block of 9 lines with N x 9 columns each (N = 1, 4, 16).

The **Path Overhead POH** and container C4 are forming the virtual container VC4.

The SCU module permits access to the Section Overhead Bytes (SOH) and VC4 POH bytes (D, E, F and auxilliary byte).

The D-bytes (DCC_M, DCC_R) can be applied to the processor for further processing or switched through transparently. The E- and F-bytes are the E1, E2 and F1-byte of the Section Overhead. These can be passed through. A through-connection of the F2- and F3-byte is not possible.

Through-connection of overhead information
The following diagram shows the through-connection options for overhead information.

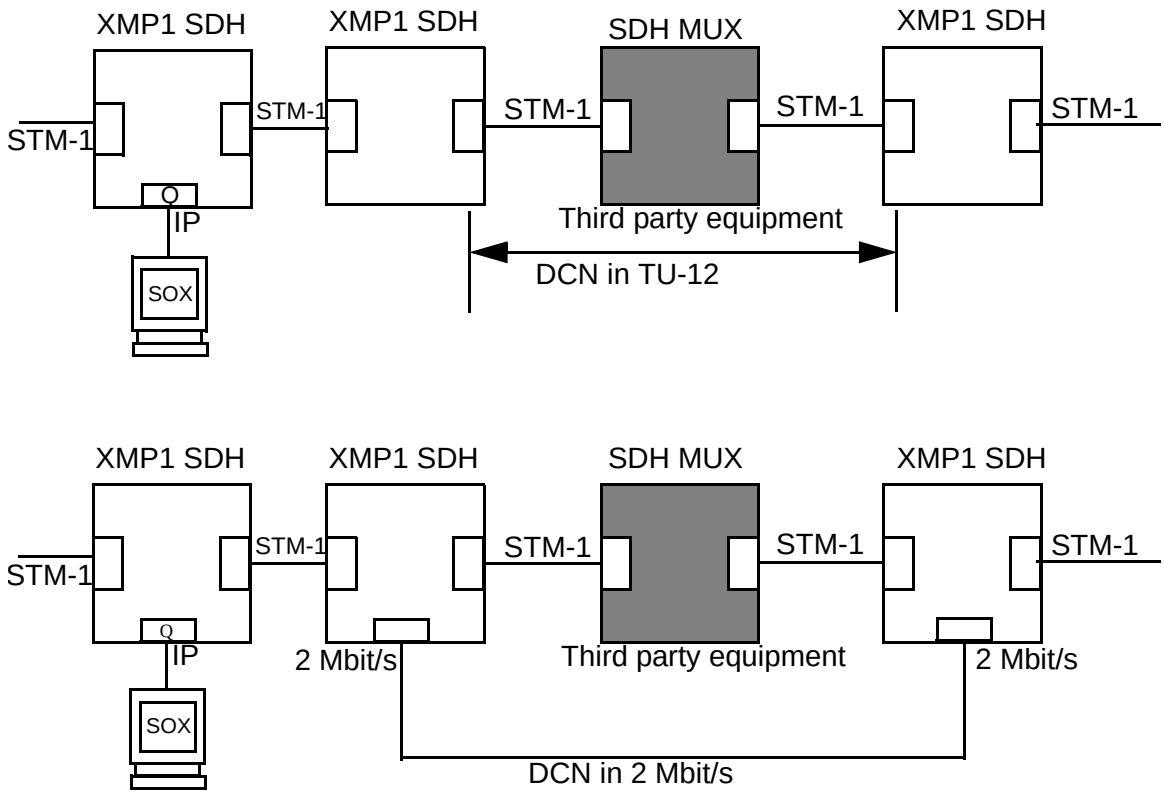


3.10.2 Management connection of the SDH expansion

The management connection of the SDH expansion is set up via the Data Communication Channel DCC of the Section Overhead. Regarding the DCC, it can be adjusted as to whether the DCC_M (Multiplex Section) or DCC_R (Regenerator Section) shall be used.

In addition, it is possible to re-route the management information and carry it via an STM-1 signal in a TU12 or via a 2 Mbit/s port (external/internal).

The SOX is connected via the LAN interface of the CU-E.



OSPF routing

The SDH expansion uses OSPF Routing Version 2 in compliance with RFC 2324.

OSPF-based IP routing requires the configuration of parameters and attributes for each network element:

- Areas
- IP interface (LAN, DCN, unnumbered)
- Static routes
- Costs
- Router type (Internal, Area Border, Backbone)

In Release 5.0, these parameters will be defined on a permanent basis in the network element.

The SDH expansion provides the following IP interfaces:

- LAN (numbered interface)
- 4 x DCC_M or re-routed via traffic channel (unnumbered interface)
- 4 x DCC_R or re-routed via traffic channel (unnumbered interface)

XMP1 network elements without SDH expansion, which are connected using 2 Mbit/s links, are managed via the XMP1-ECC.

3.10.3 DCN migration

The following drawings show the migration in different network and management scenarios if the SDH expansion is added to these networks.

The following scenario shows a pure XMP1 network without SDH expansion managed by means of SOX. This network is connected to SOX via IP or RS232.

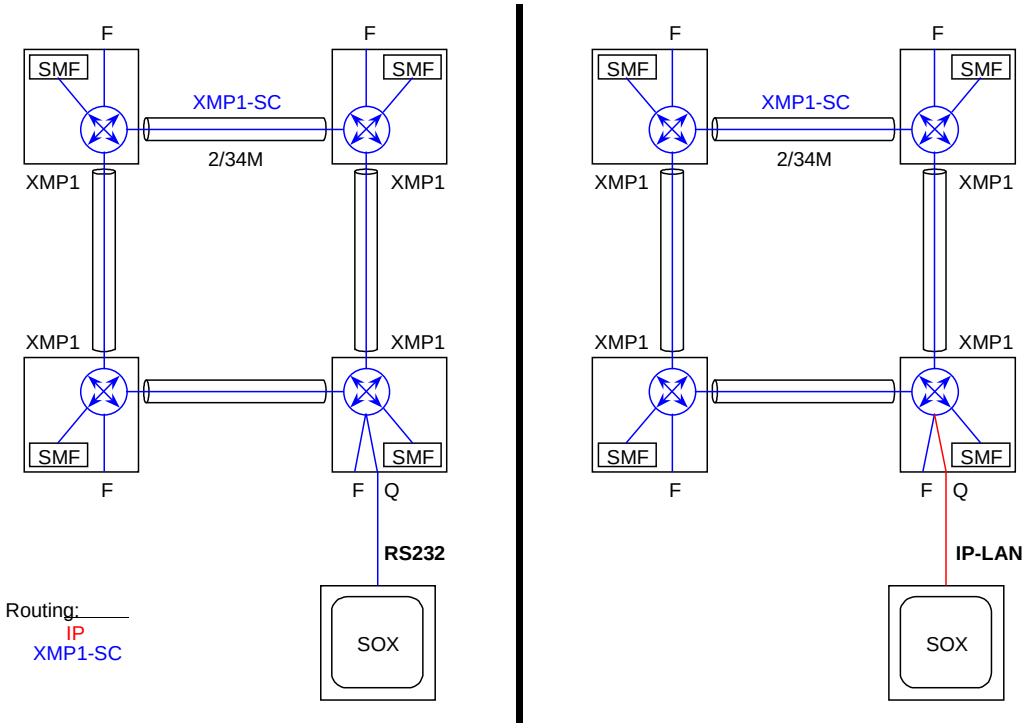


Figure 3.13: Managing an XMP1 network without SDH expansion by means

The following scenario shows a pure XMP1 network with SDH expansion managed by means of SOX. This network is connected to SOX via IP.

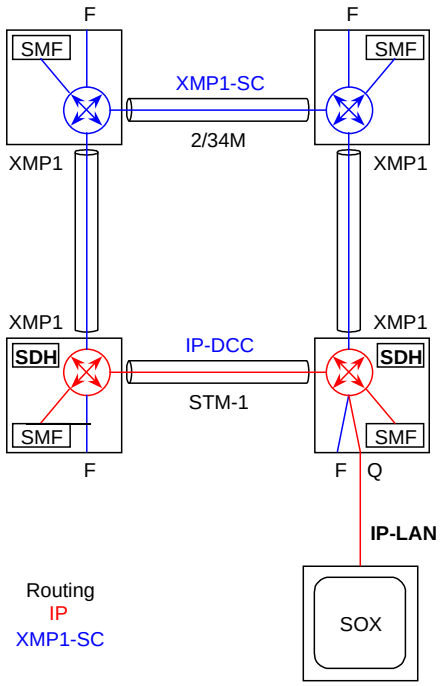


Figure 3.14: Managing an XMP1 network with SDH expansion by means of

The following scenario shows an XMP1 network and an SDH network managed by means of SOX and SOA.

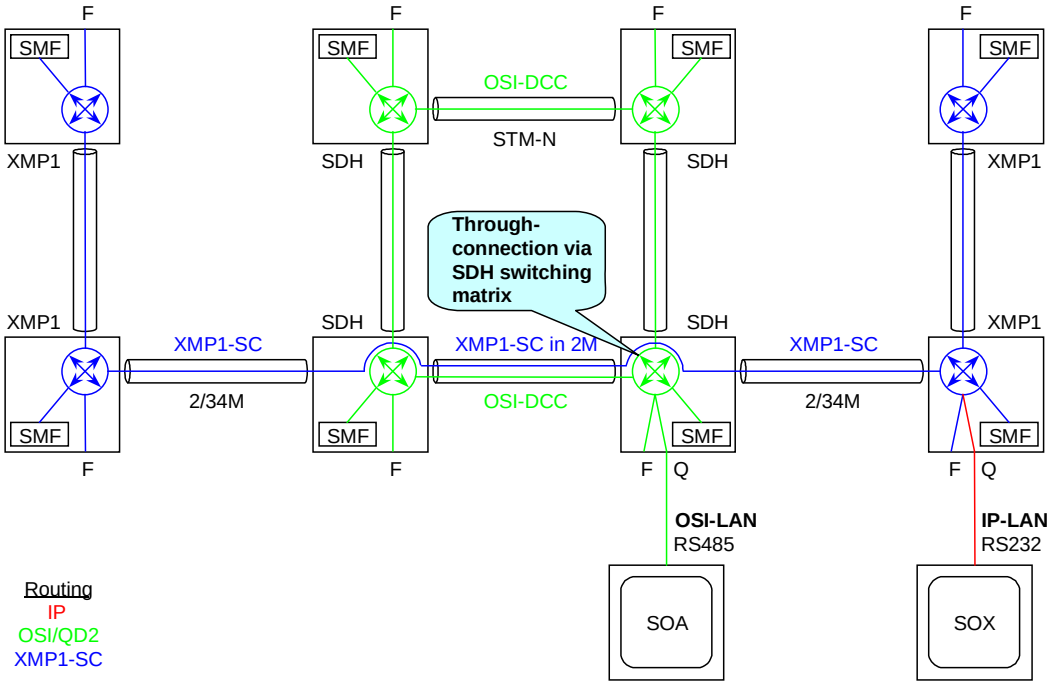


Figure 3.15: Mixed XMP1 and SDH network managed by means of SOX and

The following scenario shows an XMP1 network with SDH expansion and an SDH network managed by means of SOX and SOA.

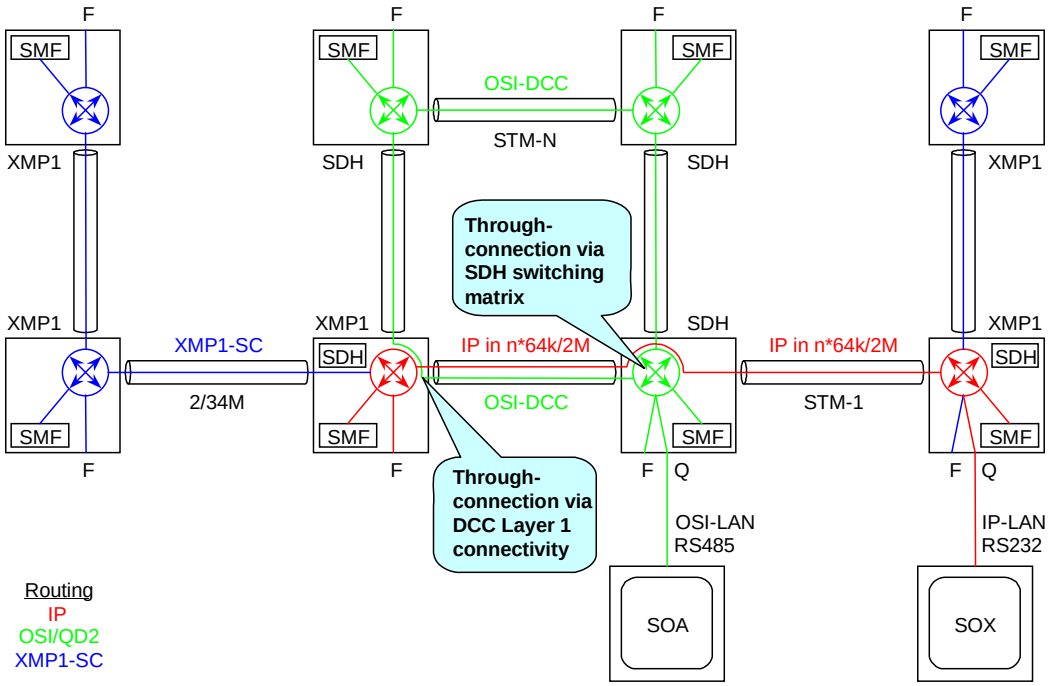


Figure 3.16: XMP1 with SDH expansion and SDH network managed by means of SOX and SOA

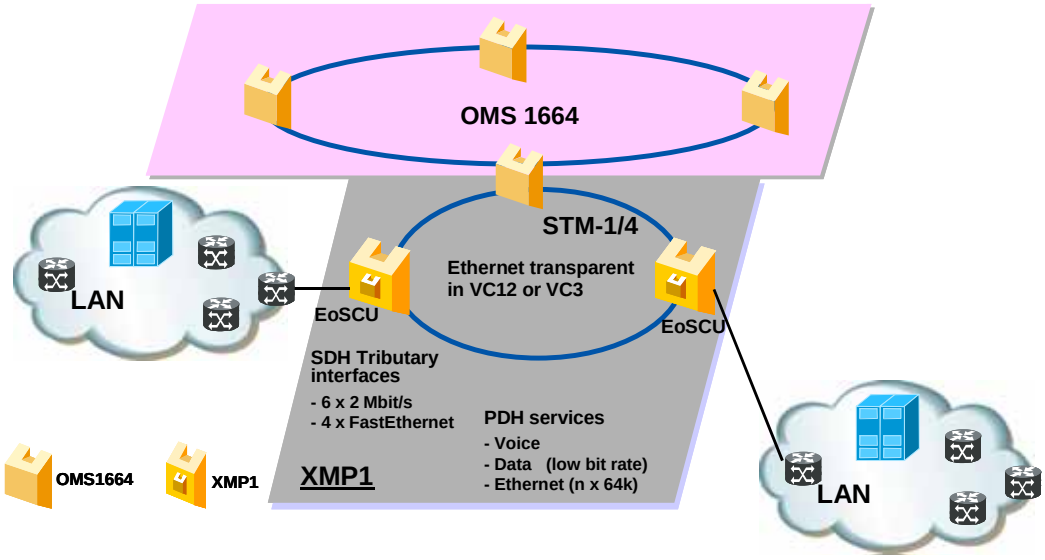
Chapter 4
Ethernet over SDH in the XMP1 System

4.1 Introduction

The four Fast Ethernet ports available on the **E**thernet **o**ver **S**DH **C**ore **U**nit **(EoSCU)** module of the XMP1 system are provided for 'Transparent LAN Services' (TLS). They permit a point-to-point transmission of Ethernet signals between two units equipped with Ethernet interfaces via the SDH network. Ethernet traffic is transported transparently from one end of the SDH network to the other.

For this purpose, the 'Encapsulation' procedure GFP (Generic Framing Procedure) is used. Transmission in the SDH network takes place either via a single virtual container (VC-12, VC-3) or a group of several concatenated VCs.

The Ethernet over SDH Core Unit (EoSCU) module is based on the SDH Core Unit (SCU) module of the SDH expansion.



4.2 Design of the EoSDH Expansion

The Ethernet expansion is implemented in the XMP1 system by means of the following modules:

- EoSCU (Ethernet over SDH Core Unit)
- CU-E (Central Unit Expansion)

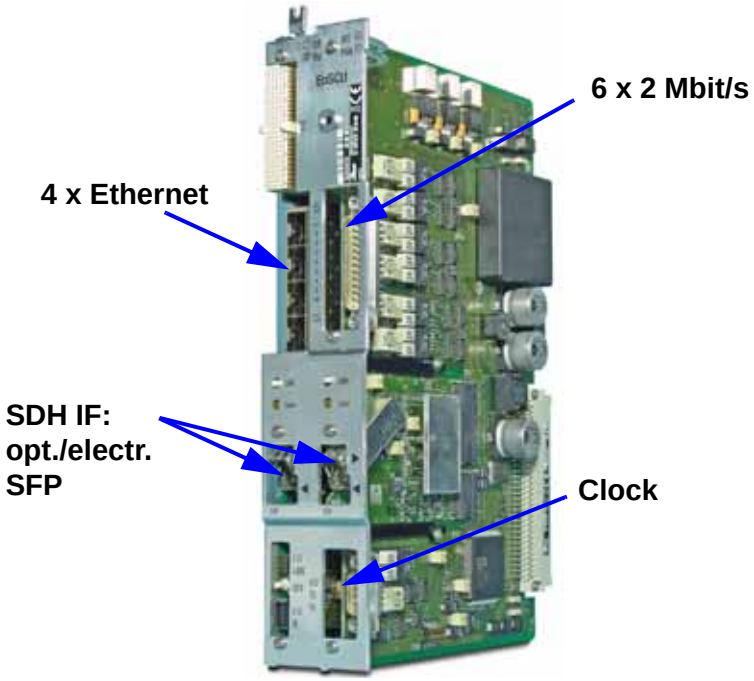
The Ethernet expansion of the XMP1 system is implemented by the **EoSCU** module. This module occupies two card slots in the XMP1 subrack. The **CU-E** sub-module is used as control module. It is mounted on the Central Unit (62.7040.xxx.xx) of the node.

EoSCU (Ethernet over SDH Core Unit)

The **EoSCU** (Ethernet over SDH Core Unit) module is composed of the **SCU-BETH** and **SCU-EETH** boards.

SFP modules (Small Form Facture Pluggable Modules) are used for the optical STM-1/4 interfaces and the electrical STM-1 interface. These SFP modules carry out the opto-electrical conversion of the interface signals. The optical fibers are connected via LC plug connectors.
At the electrical STM-1 interface, the connection is set up using coaxial (straight) 1.0/2.3 plug connectors.

Ethernet SDH Core Unit EoSCU



SCU-EETH

Please refer to the SDH expansion, Section 4.2, *Design of the EoSDH Expansion* .

SCU-BETH

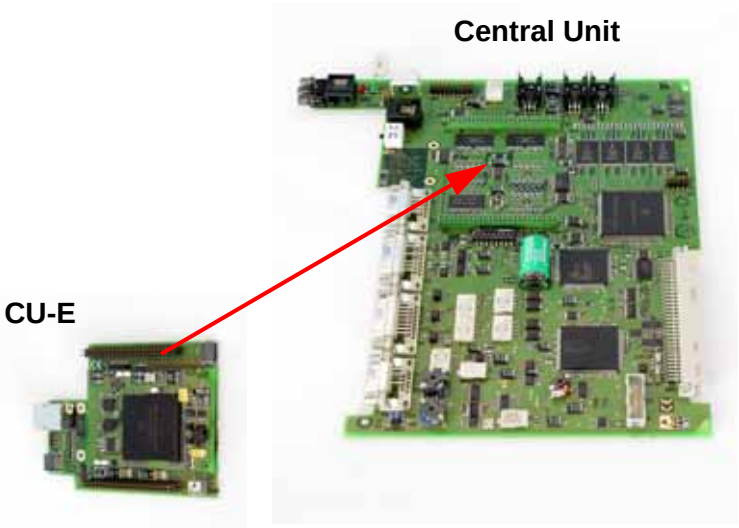
The SCU-BETH board provides four Ethernet interfaces, one line interface as well as internal 2 Mbit/s interfaces. The four Ethernet interfaces can be equipped with electrical and optical SFPs.

The following SFP types are available for this purpose:

- 100Base TX electrical
- 100Base FX (optical fiber)
- STM-1 S1.1 100Base LX10

CU-E (Central Unit Expansion)

The **CU-E** (Central Unit Expansion) board is an expansion module for the Central Unit of the node. It provides the control functions and management interfaces to the SCUs (SDH Core Units).



4.3 Ethernet Functions

The Ethernet expansion of the XMP1 system supports the following functions:

- EPL (Ethernet Privat Line)
- Transparent transmission via SDH (VC-12, VC-3)
- Data rates up to the maximum velocity of the Ethernet interface
- Virtual Channel Concatenation (VCAT)
- GFP-F Framing Procedure
- Link Capacity Adjustment Scheme (LCAS)
- Link Loss Forwarding (LLF)
- Pause
- Auto-Negotiation
- Auto-MDIX

Ethernet Private Line (EPL)

Ethernet traffic signals are transported via the SDH network over an Ethernet Private Line (EPL). In its simplest form, this can be a simple point-to-point connection between two physical Ethernet interfaces.

Although an Ethernet interface is assigned a certain bandwidth (10Mbit/s, 100Mbit/s) on a permanent basis, the traffic volume to be transported via the corresponding port is much smaller most of the time. In contrast to PDH systems, the signals are not permanently assigned to a certain VC type at the physical interface. Instead the Ethernet traffic is typically transported in a group of concatenated VCs via the SDH network, the number of VCs and VC types being sufficient for transmitting the Ethernet traffic bandwidth agreed.

Generic Framing Procedure (GFP)

The Generic Framing Procedure (GFP) provides an 'Encapsulation' mechanism for Ethernet MAC frames in compliance with IEEE 802.3 and their transmission via an SDH carrier.

LCAS

The Link Capacity Adjustment Scheme (LCAS) controls the link capacity using virtual concatenation. The capacity is reduced automatically as soon as one or several VCs in the group detect an error in the network. The capacity is in turn increased again automatically as soon as this error is eliminated. The LCAS procedure permits an error-free and hitless addition and deletion of VCs in a concatenated group.

Link Loss Forwarding (LLF)

Link Loss Forwarding is a mechanism with alternative routing processes offering protection in the data equipment connected.

Pauses

In Ethernet transmission, pause frames provide a so-called flow-control mechanism slowing down the Aggregate transmission rate of the frames sent by the far end.

Auto-Negotiation

The Auto-Negotiation function enables the Ethernet port and Ethernet unit connected to the latter to select the Ethernet connection parameters automatically based on the features of the equipment units connected. These parameters include - for example - the transmission rates possible as well as full-duplex or half-duplex operation. In addition, the user can narrow down the auto-negotiation process by confining the specified features of the port.

Auto-MDIX

The Auto-MDIX (Automatic Medium-Dependent Interface Crossover) function permits the automatic adaptation of the transmit and receive line of a port, i.e. of the Ethernet cable connected (patch cable/cross-over cable).

4.4 Interfaces

The Ethernet expansion provides the following interfaces in the XMP1 system:

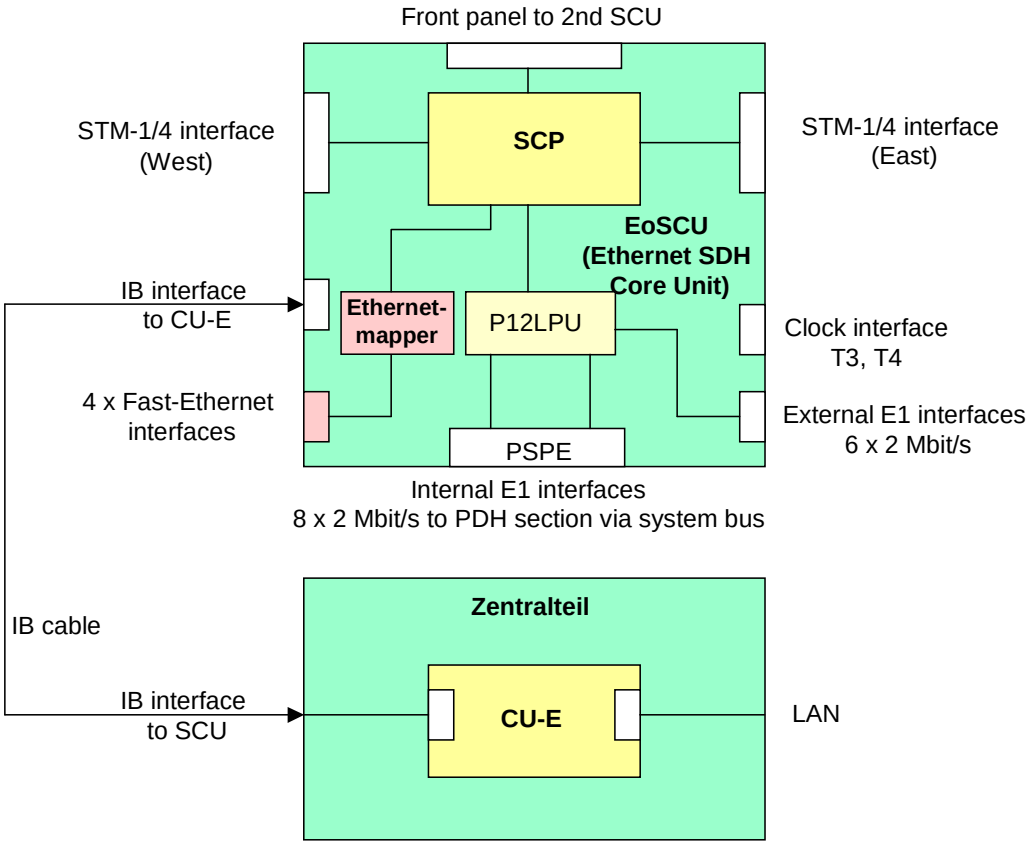


Figure 4.1: Interfaces of the Ethernet expansion

Ethernet interfaces

The SCU-BETH board provides four Fast Ethernet interfaces. These can be equipped with electrical and optical SFPs and any combination of both.

Table 4.A: Ethernet interfaces

100Base TX electrical	2401292-0013	RJ45, 100 m
100Base FX (optical fiber)	1400800-0011	1300 nm, 0-13 dB/2 km
STM-1 S1.1 100Base LX10	1400729-0027	1300 nm, 0-10 dB/10 km

Optical STM-1/4 interfaces

The optical SDH interfaces are provided by SFPs. These SFPs can be supplied with 1300 nm and 1550 nm optics.

Connection is implemented using LC-type plug connectors.

The following SFPs are available:

Table 4.B: SFPs for optical STM-1/4 interfaces

STM-1	
SFP STM-1 S1.1 SH 1300	1400729-0027
SFP STM-1 L1.1 LH 1300	1400744-0051
SFP STM-1 L1.2 LH 1550	1400744-0044
STM-4	
SFP STM-4 S4.1 SH 1300	1400744-0010
SFP STM-4 L4.1 LH 1300	1400744-0028
SFP STM-4 L4.2 LH 1550	1400744-0036

Application class syntax (acc. to ITU-T G.957):

The application class is described using the following syntax:

Application - STM level - Wavelength range

L 1 . 1

Application:
S: Short-haul,
distance up to about 15 km
L: Long-haul,
distance up to about 40 km with 1300 nm,
distance up to about 80 km with 1500 nm

STM level:
1: STM-1
4: STM-4

Wavelength range:
.1: Wavelength range: 1300 nm
.2: Wavelength range: 1500 nm

The lasers used for the optical interfaces meet Laser Class 1 conditions both in operation and in case of a fault. The lasers are maintenance-free.

Electrical STM-1 interfaces

The electrical line interface STM-1 is implemented using electrical SFPs.
The following SFPs are available:

Table 4.C: SFP for electrical STM-1 interfaces

SFP STM-1 EL	9500001-0017	

Connections are implemented using coaxial 1.0/2.3-type plug connectors.

E1 interfaces

The following interfaces are available for 2 Mbit/s signals:

- 8 x 2 Mbit/s to the XMP1 PDH kernel via the system bus
- 6 x 2 Mbit/s, 6 dB equipment interfaces (In-house) for the external connection of electrical 2 Mbit/s signals acc. to ITU-T G.703 (unstructured and structured acc. to ITU-T G.704).

Timing interfaces

The EoSCU module provides the timing interfaces T3 and T4. The T3 interface permits an external T3 clock of 2048 kHz to be connected. The impedance of this interface can be set to highly resistive, 120 Ohms or 75 Ohms.

The T4 timing interface supplies a 2048 kHz clock for synchronizing external units.

LAN (CU-E)

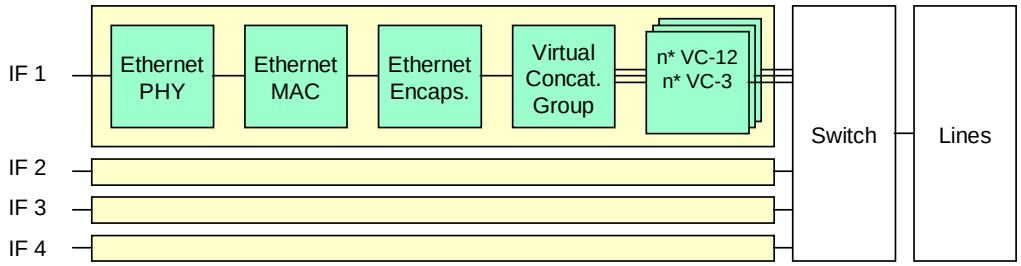
The LAN interface on the CU-E (Central Unit Expansion) is used to connect a network management system via a LAN infrastructure.

Internal bus (IB)

Communication between the EoSCU module and CU-E (Central Unit Expansion) sub-module mounted on the Central Unit takes place via the internal bus (IB).

4.5 Multiplex Structure

The following drawing shows the most important function blocks relevant for Ethernet-over-SDH transport.



The following Ethernet-specific functions are used for transport purposes:

- Ethernet PHY
- Ethernet MAC
- Ethernet Encaps
- Ethernet Virtual Concatenation Group

The configuration options available are listed in the following:

Ethernet PHY

- Duplex mode and status (half / full / auto)
- Transmission rate and status
- Auto-negotiation mode (on/off), status
- Cross-over mode and status (MDI, MDIX, auto)

Ethernet MAC

- Link activation (up / down)
- MAC address
- MTU size
- Ethernet mapping (VC-12, VC-3)
- Pause mode

Ethernet Encapsulation

- Encapsulation type GFP-F
- Frame Check Sequence
- Received/expected User Payload identifier
- Link Loss Forwarding
  - Consequent action
  - LLF signalling
  - Persistency

Ethernet Virtual Concatenation Group

- Concatenation LCAS

- VCG configuration
- Adding VC to VCG
- Deleting VC from VCG
- Minimum number of VCs in VCG
- Actual, configured, maximum number of VCs
- Wait to restore time

4.5.1 Traffic architecture

The Ethernet expansion is primarily based on the functions of the SDH Core Processor (SCP). The latter provides the functions required for data processing and switching.

The following drawing gives an overview of the traffic architecture and connections between two EoSCU modules and the PDH kernel of the XMP1 system.

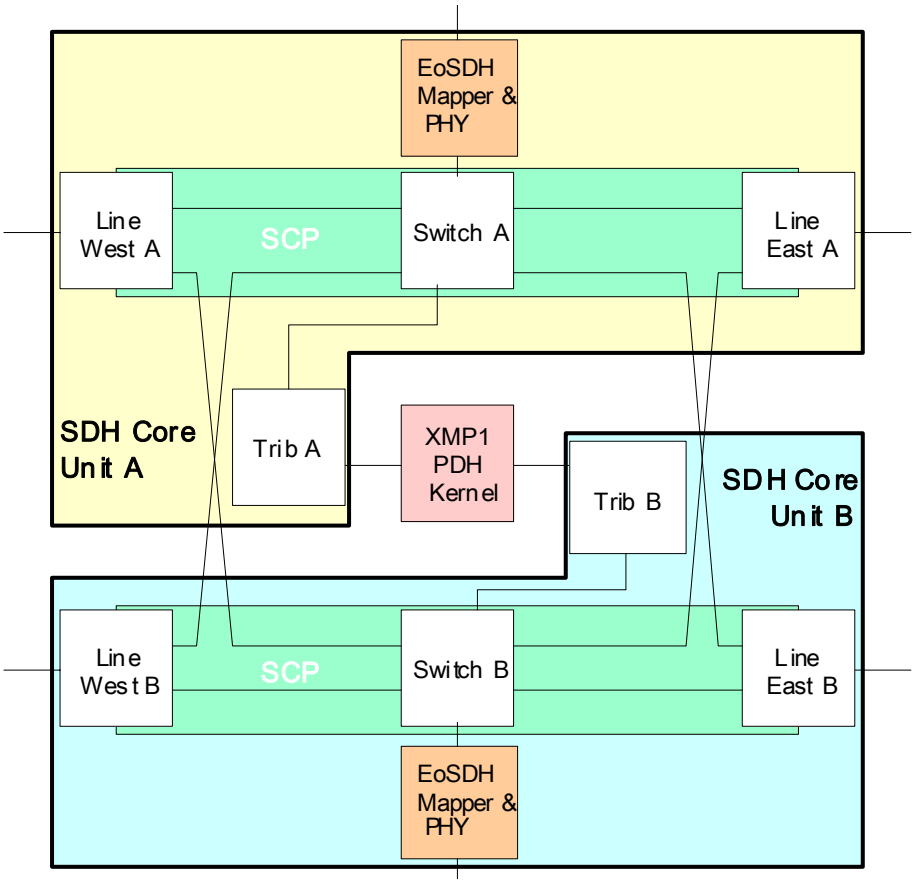


Figure 4.2: Traffic architecture

Connections between the SDH section and PDH kernel

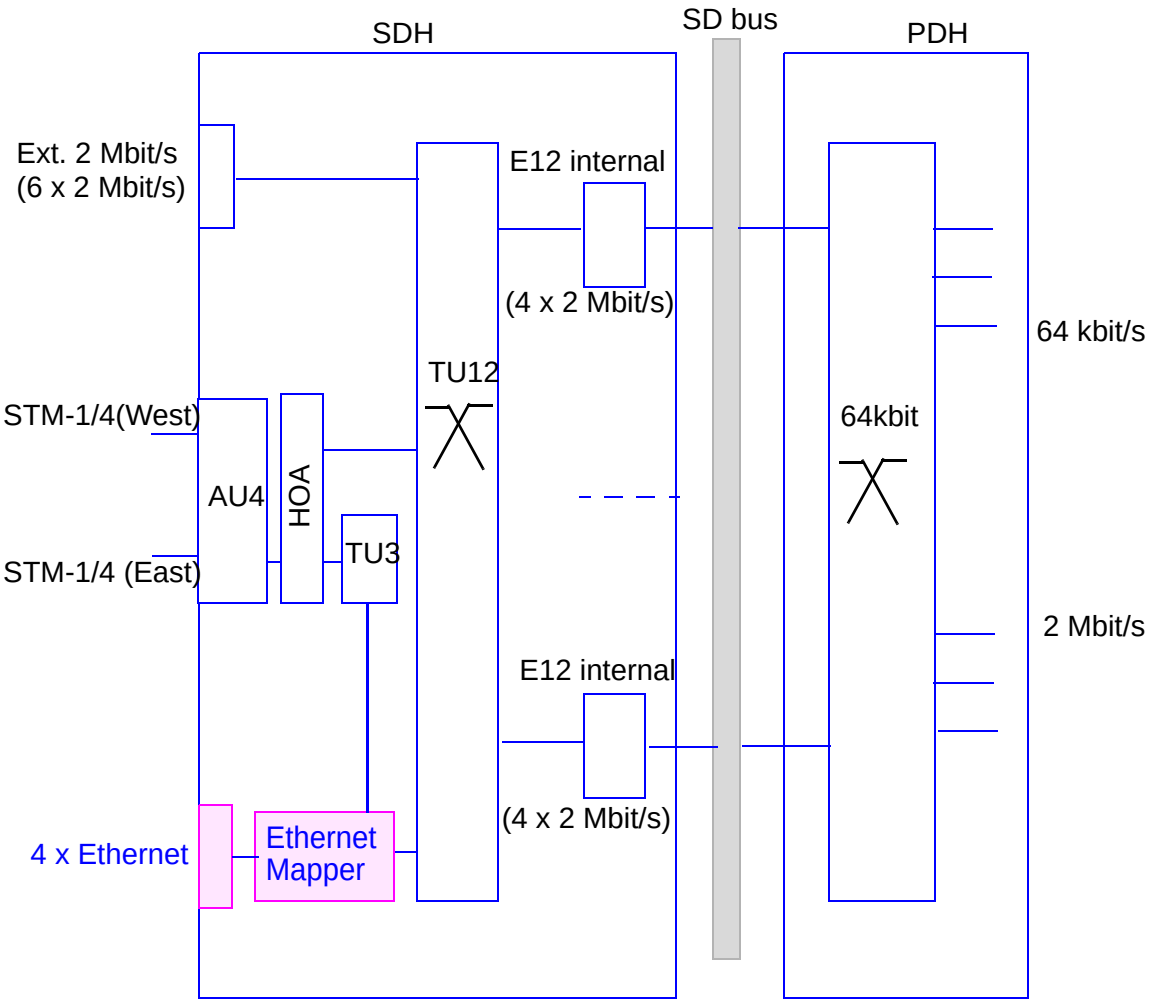
The Ethernet expansion provides four Ethernet interfaces, the STM-1/4 interfaces and a total of 6 x 2 Mbit/s interfaces for connecting external 2 Mbit/s signals.

In the PDH kernel direction, eight 2 Mbit/s interfaces are available for switching purposes.

The 64kbit/s switching matrix is used to apply the data of the PDH kernel to the internal 2 Mbit/s interfaces (E12 internal) of the SDH expansion. Then the corresponding VC-12 is switched via the TU12 switching matrix in the STM-1 or 2 Mbit/s direction (external).

Depending on the configuration, the Ethernet data are mapped either into VC-12 or VC-3 virtual containers. Up to 3 x VC-3 or 63 x VC-12 are provided for transmission of the Ethernet data available at the four Ethernet interfaces.

The following drawing shows the switching matrices used and the resulting switching options available between the SDH expansion and PDH kernel of the XMP1 system.



4.6 SDH Mapping/Concatenation

- Ethernet data, consisting of consecutive frames of any valid size, can be mapped into either VC-12 or VC-3 of the STM-1 signal with the following conditions:
  - — Mapping Ethernet data to nx VC-12 (n=1 to 63) for all Ethernet ports of the module. Maximal 63 VC-12 (STM-1 capacity) are supported.
  - — Mapping Ethernet data to m x VC-3 (m=1 to 3) for all Ethernet ports of the module. Maximal 3 VC-3 (STM-1 capacity) are supported.
  - — The combined use of V-C3 and VC-12 is possible within the limits specified above.
    Example:
    1 x VC-3 and 42 x VC-12
    2 x VC-3 and 21 x VC-12
    3 x VC-3, no VC-12
    63 VC-12, no VC-3
- The EoSCU module provides four Ethernet interfaces for operating with high transmission rates up to 100 Mbit/s.
- With GFP, an 'Encapsulation' mechanism is provided for Ethernet MAC frames in compliance with IEEE 802.3 and their transmission via an SDH carrier. This procedure is defined in ITU-T Recommendation G.7041/Y.1303.
- Resizing of VC-12 and VC-3 groups is supported using the LCAS (ITU-T G.7042). The size of the group can be changed without discontinuity the Ethernet service.
- The maximum differential delay supported on VC-X links is 32 ms.

4.7 Clock Supply

Please refer to Section 3.6, *Clock Supply* .

4.8 Performance Management

Performance management is divided up into two categories. Ethernet performance counts are handled using the generic performance data collection and reporting of data at 15-min. and 24-hr intervals. In addition, a shapshot of the current Ethernet performance data can be requested.

Chapter 5
SDSL in XMP1

5.1 General

SDSL (international designation: SHDSL) is a further development of the HDSL technology introduced some years ago. The SDSL TC-PAM16 line code standardized by both ETSI and ITU permits nearly the same transmission range on one copper pair as HDSL on two pairs. With two pairs and high-quality cables, SDSL can span longer distances than HDSL.

Advantages of SDSL:

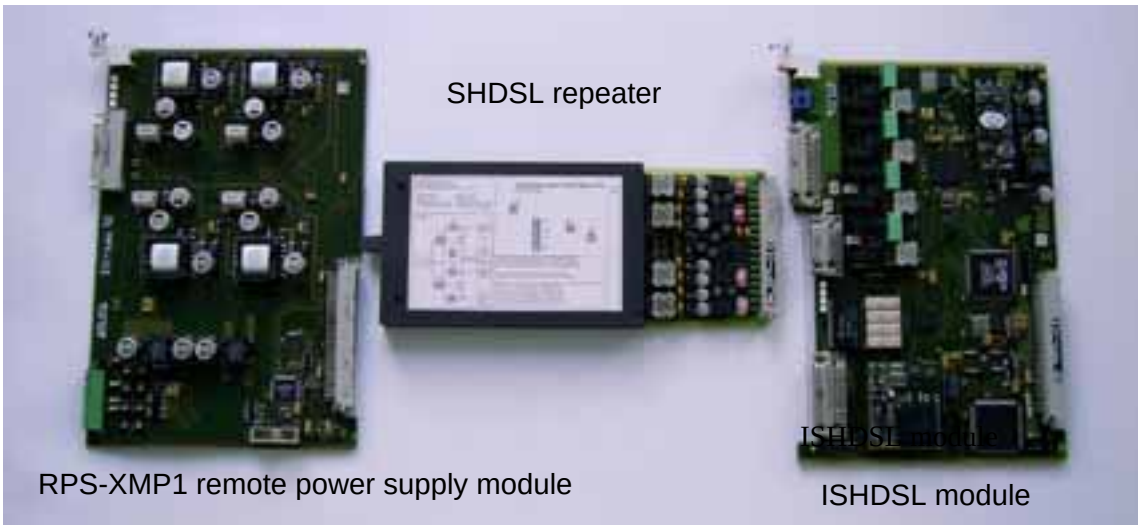
- Good spectral compatibility with other services in the same cable;
- Management of up to 8 repeaters (1 pair or 2 pairs) on one line section;
- Improved jitter/Wander behavior for series switching of line sections;
- Transmission of sub-bit rates (nx64, n=3...32) for a further increase in the transmission range.

In case of short line sections, the implemented power backoff function automatically reduces the transmit power to a value ensuring that interferences affecting neighboring services can be kept as low as possible.

5.2 SDSL extension in XMP1

The SDSL extension in the XMP1 system includes the following modules:

- ISHDSL module (05HAT00070AAL)
- RPS-XMP1 remote power supply module (05HAT00071AAN)
- SHDSL repeater (05HBA00123AAD)



ISHDSL module

In the SDSL line equipment of the XMP1 system, the ISHDSL module (05HAT00070AAL) provides four SDSL interfaces, four external E1 interfaces and four internal E1 interfaces to the XMP1 kernel.

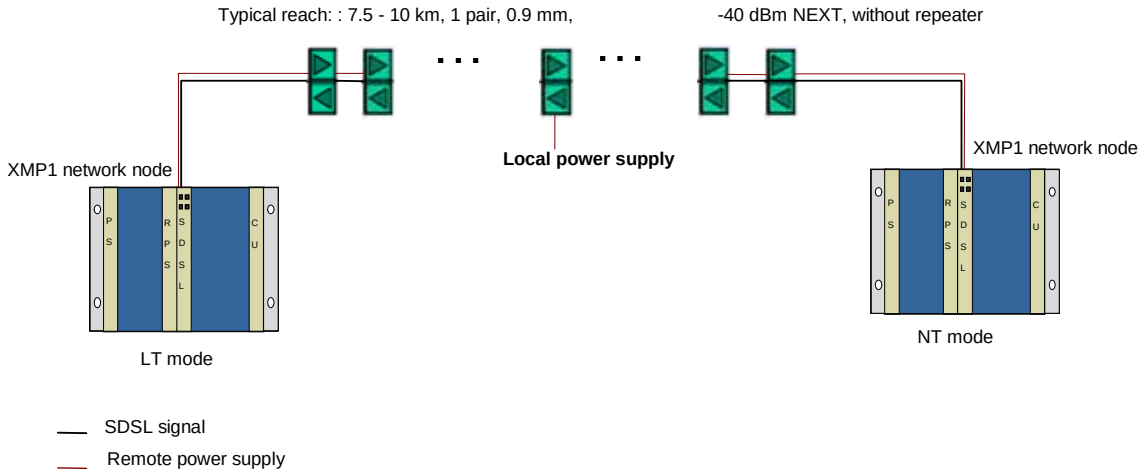
RPS-XMP1 remote power supply module

The optional RPS-XMP1 remote power supply module (05HAT00071AAN) provides four remote supply voltages of -116 V for powering the SHDSL repeaters. The remote supply voltage is applied to the ISHDSL module via its front cabling.

SHDSL repeater

In the SDSL link, the SHDSL repeater (05HBA00123AAD) designed in compliance with ITU-T G.991.2 is used to regenerate the iSDSL signals. Up to eight (8) SHDSL repeaters can be installed on one link.
The SHDSL repeaters can be powered by the RPS XMP1 remote power supply module and/or a local power supply. SHDSL repeaters can be installed either in underground tray sleeves or in the cable distributor (way-side cabinet).

The following figure shows a typical application of the SDSL line equipment in the XMP1 system.

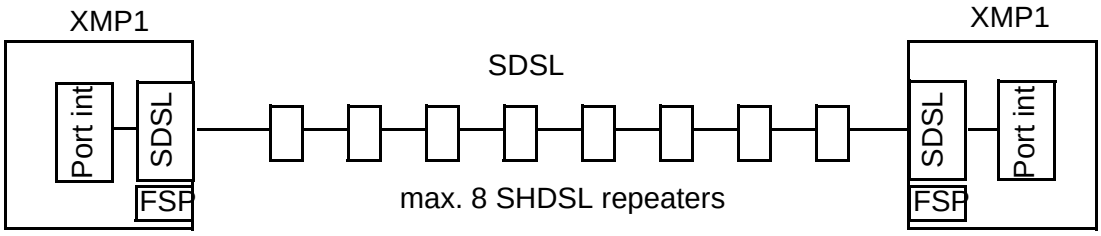


In XMP1 subracks already available, the SDSL extension can be used in two different modes:

- Integrated SDSL
- Stand-alone SDSL

Integrated SDSL

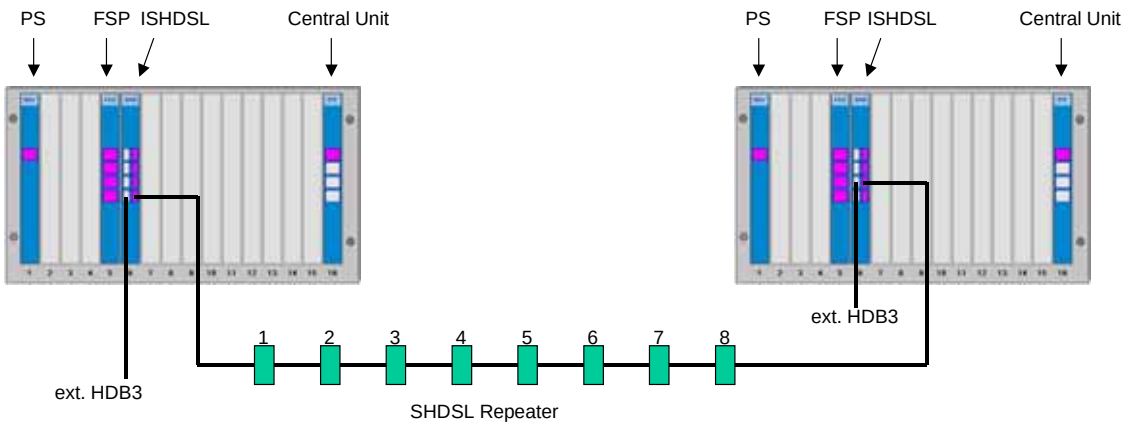
In the "integrated SDSL" mode, the SHDSL extension represents an alternative to an external SHDSL solution and/or can be used as substitute for HDB3 port modules. The ISHDSL module provides four internal 2 Mbit/s interfaces to the XMP1 system. 2 Mbit/s signals from the switching matrix of the XMP1 system can be routed via these interfaces and can be applied to the SHDSL interface.



Stand-alone SDSL

In this operating mode, a XMP1 subrack can be used as low-cost SDSL transmission system without multiplexing and cross-connect functions. Only the external 2 Mbit/s interfaces are used. Cross-connections via the switching matrix are not possible. In this application, the XMP1 subrack will be equipped only with the central modules such as the Central Unit and power supply module as well as with the SHDSL and FSP modules required for the SDSL application.

The configuration is performed by means of the SOX LCT.


PS
FSP ISHDSL
Central Unit
PS
FSP ISHDSL
Central Unit
ext. HDB3
1
2
3
4
5
6
7
8
ext. HDB3
SHDSL Repeater

5.3 Interfaces

In the XMP1 system, the SDSL expansion provides the following interfaces:

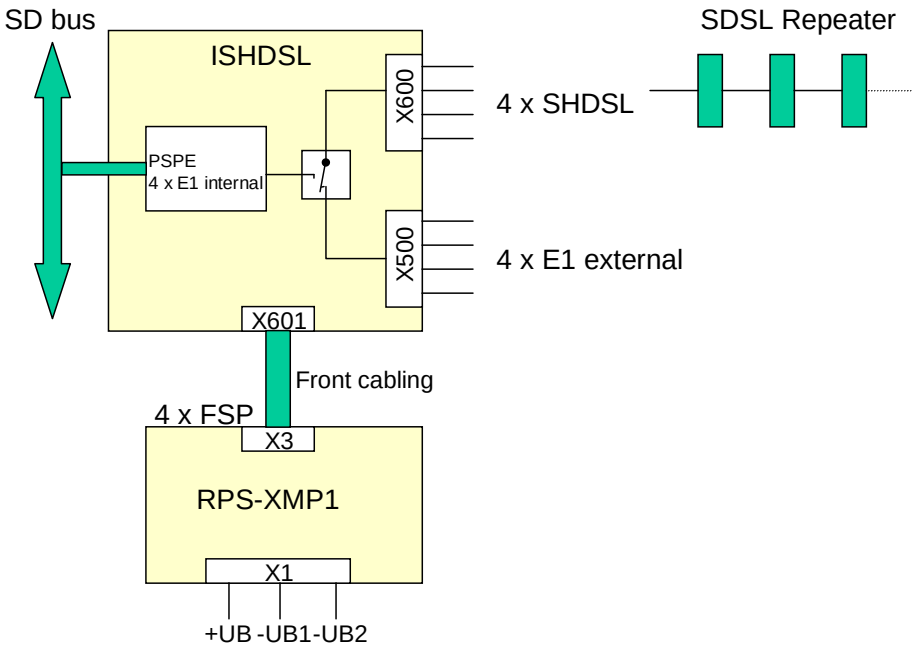


Figure 5.1: Interfaces - SDSL expansion

5.3.1 SHDSL

The SDSL interface of the SHDSL line equipment can be configured for 1-pair operation (2-wire) or 2-wire Highspeed operation. The 4-wire mode (2 pairs) is in preparation. Transmission is full-duplex for each pair. The required separation of directions is ensured by an echo compensation procedure. An a/b reversal within a pair is permitted.

For applications not requiring the entire traffic bandwidth of 2048 kbit/s, it is possible to transmit with a lower bandwidth and achieve a longer coverage range. The traffic bandwidth can be configured to any value in the range of nx64 kbit/s
(n= 3.....32).

On a SDSL link, one terminal must be configured as Master (LT), the other one as Slave (NT). The required traffic bit rate is adjusted in the LT. The values set are then taken over by the NT (Rate Adaption).

The management of a complete transmission section including repeaters is performed by the Master (LT). An 8 kbit/s EOC channel integrated in the SDSL signal and transmitted on the trunk line together with the traffic data is used for this purpose. This EOC channel permits each unit available on the SDSL link to be accessed by the user.

A transmission link with repeaters synchronizes itself section by section starting from the LT. During the standardized startup procedure, the units adapt themselves to the individual line parameters (e.g. attenuation, interference effects) and set up the EOC channel. The values determined in the course of this "line probing" can be called up by means of an equipment status request.

An important system parameter is the noise margin, i.e. the system margin of a link section. In compliance with the relevant ETSI standard, a link with a system margin of 0 dB can have a bit error ratio of BER 1.E-7. For a secure and stable operation, a value of at least 6 dB is recommended. In individual cases, other values can be used after an appropriate BER measurement.

In case of a failure of a repeater section, all SDSL sections between the place the error occurred and the NT will be deactivated. A LINK LOSW and LINK Rep alarm will then be generated in the terminals.

Using the CRC6 check sum generated in the SDSL frame, a performance data evaluation in compliance with ITU-T G.826 can be carried out at any time without disturbing normal operation.

Power backoff function

The power backoff represents a Tx power reduction. The backoff factor is indicated in dB. A value of 0 dB means that the maximum transmit level will not be reduced.

The line attenuation is determined during SDSL link setup. Using these line attenuation values, the Tx level can be reduced on short links not requiring the maximum Tx power. Thus, interference affecting adjacent transmission links implemented via the same cable can be kept low.

The power backoff mode is possible both in automatic and manual operation. The corresponding setting is made via the user interface. Using the online functions made available by the operator software, the S/N and power backoff values adjusted during link setup can be requested via the "Link Measured Values" option.

Transmission range

The transmission range depends on the line attenuation and noise or interference level on the line. This interference level is determined by the following factors:

- near-end cross-talk attenuation between the wire pairs (NEXT)
- number of "interfering" systems connected to the cable.

Systems offering xDSL services and operating in the same transmission frequency band represent interferers primarily affecting the noise balance. For a realistic assessment of the achievable coverage range, both the required system margin and the factors mentioned above must be taken into account.

Table 5.A: Transmission ranges - Approximate values

CONDUCTOR DIAMETER	KILOMETRICAL ATTENUATION @ 200 KHZ	NOISE LEVEL CAUSED BY NEAR-END CROSS-TALK ATTENUATION (NEXT)	MAX. RANGE WITH 1-PAIR OPERATION
0.4 mm	11 dB	-40 dBm	2.2 km
0.6 mm	6 dB		4.2 km
0.9 mm	3.5 ... 4.5 dB		5.5 ... 7 km
1.2 mm	2.5 ... 3.3 dB		7.5 ... 10 km

Assumption: At least 6 dB system margin, NEXT ≥ 55 dB, parallel operation of one or two SDSL links at 2048 kbit/s.

Under favorable conditions, i.e. low line attenuation combined with minimum noise, the values specified above can be clearly exceeded.

A further increase in the coverage range is possible by reducing the transmission bandwidth (see Fig. 5.2: Power spectral densities at 2048 kbit/s).

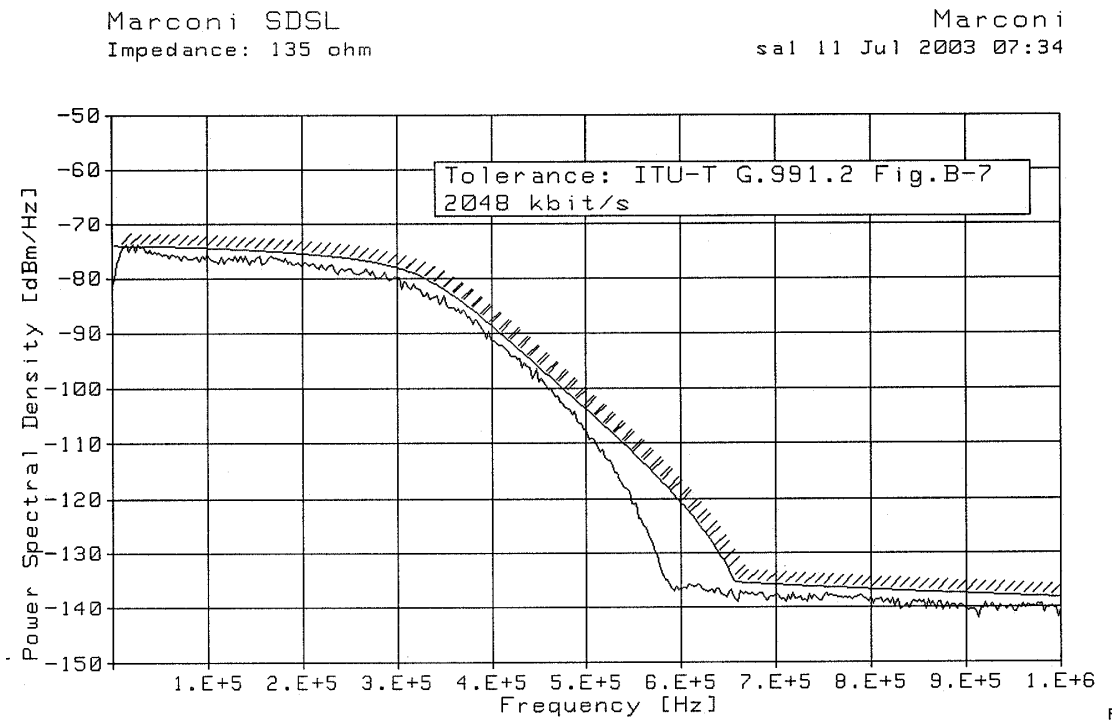


Figure 5.2: Power spectral density - SDSL 2048 kbit/s

5.3.2 E1 interface

The ISHDSL module provides four external E1 interfaces and four internal E1 interfaces to the XMP1 kernel.

If the SDSL line equipment is used as stand-alone system, only the external E1 interfaces are used. The E1 signal is passed on transparently to the SHDSL interface without CAS termination.

The E1 interface complies with the classical ITU-T G.703/G.704 recommendations. In case of a full 2048 kbit/s transmission bandwidth, the user can select between structured operation (G.704) and transparent operation.

A reduced bandwidth results in a structured E1 fractional mode. Time slots not transmitted will be filled with an AIS signal on the E1 side.

Transparent mode

The transparent mode is used for transmitting any E1 signals. The E1 signal requires no frame structure. In case of a signal failure, AIS will be injected. This operating mode does not permit E1 performance data evaluation.

Structured mode (G.704)

For this operating mode, the E1 signal must have a PCM30/31 frame structure. The evaluation of the frame alignment signal, CRC4 frame and E bits permits the display of E1 performance data. Depending on the application, time slot 0 (TS0) processing can be configured in different ways.

Adjustable TS0 modes:

- Transparent through-connection
- Terminating operation without CRC4
- Terminating operation with CRC4
- XMP1 frame alignment signalling (always with CRC4)

5.4 Remote power supply

The SDSL repeaters used in the SDSL line equipment can be remotely powered by the RPS-XMP1 remote power supply module or a local power supply.

The RPS-XMP1 remote power supply module (05HAT00071AAN) provides four remote supply voltages of -116 V. In the XMP1 subrack, this module is mounted in a card slot adjacent to the ISHDSL module.
The SHDSL repeaters are fed with the remote supply voltage for the SDSL link via the signal wires. The RPS-XMP1 remote power supply module permits up to three SHDSL repeaters (05HBA00123AAD) to be remotely powered from each side of the SDSL link. The RPS-XMP1 and ISHDSL modules are interconnected by means of the RPS-XMP1 connecting cable. The SDSL link can be remotely powered both from the LT and NT side. Remote powering is activated in the LT or NT via the operator software.

SHDSL repeaters

- can be remotely powered via the signal wires from the LT or NT direction;
- pass on the remote supply voltage to the next SHDSL repeater;
- can be locally powered via an external mains adapter.

The required supply option can be adjusted by means of jumpers in the SHDSL repeaters.

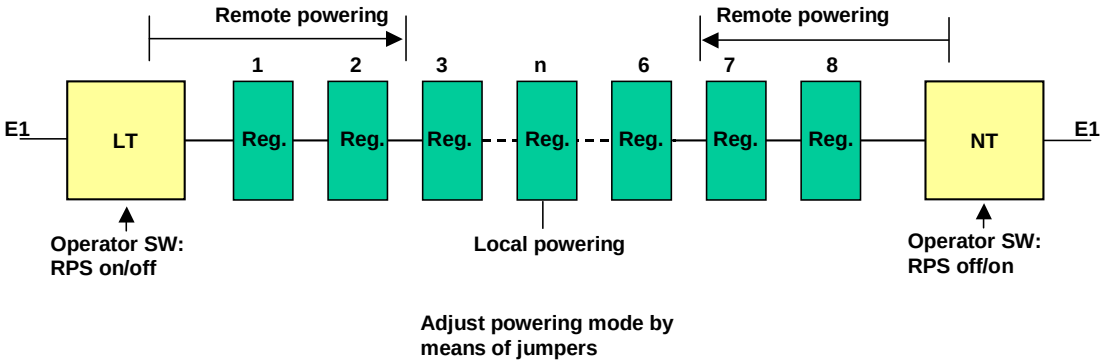


Figure 5.3: Remote powering

The powering range is limited by the ohmic loop resistance of the line. On lines with a wire diameter ≥1.2 mm, the powering range with two repeaters being remotely powered (1 pair) is normally higher than the maximum SDSL transmission range possible. In case of a wire diameter of 0.9 mm, one repeater can be remotely powered without any restriction. However, powering of a second repeater via the signal wires depends on the field length.

The following table shows examples of the powering range in the 1-pair mode.

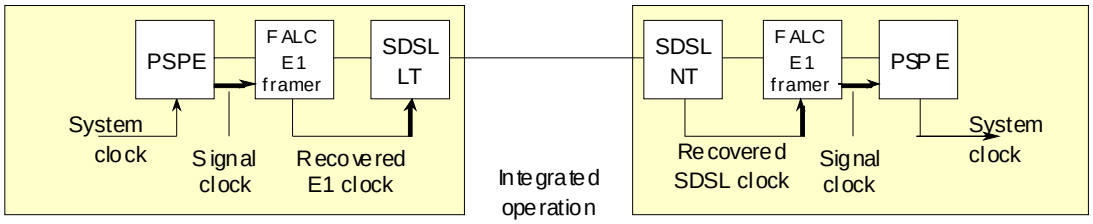
Wires used	Number of repeaters	Coverage range with ∅ 0.9 mm	Coverage range with ∅ 1.2 mm	Coverage range with ∅ 1.4 mm
1 pair	1	19.2 km	36 km	49 km
1 pair	2	2 * 6.6 km	2 * 12 km	2 * 16 km
1 pair	3	3 * 2.9 km	3 * 5.3 km	3 * 7.2 km

5.5 Clock

The SHDSL extension uses the SHDSL clock mode 1 (plesiochronous).

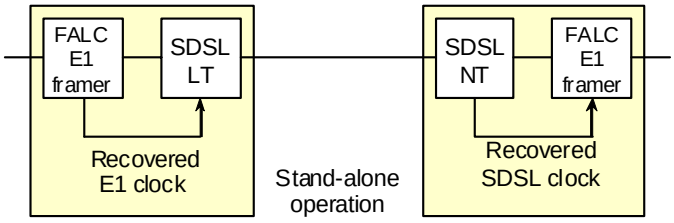
Internal 2 Mbit/s interfaces

The internal 2 Mbit/s interfaces are synchronized using the XMP1 system clock.



External 2 Mbit/s interfaces

Using the external 2 Mbit/s interfaces, the clock of the external 2 Mbit/s signal or the XMP1 system clock can be used. The appropriate setting is made via the operator software.



5.6 Loops

For testing purposes (e.g. troubleshooting), loopbacks can be switched at the LT/NT and the SHDSL repeaters.

The diagram depicted in the figure below shows the position and direction of these test loops.

1 LT/NT loop - network side direction

2...9 Repeater x loop - network side direction

10 NT loop - network side direction

11 NT E1 loop

12 Local E1 loop

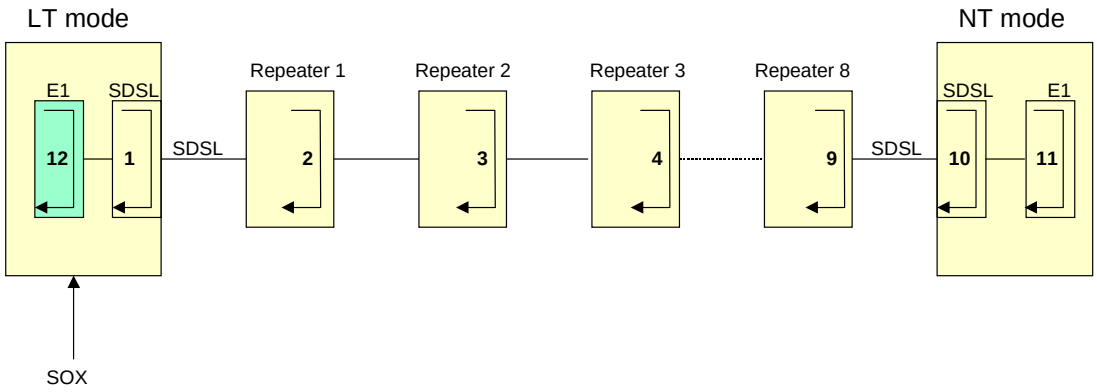
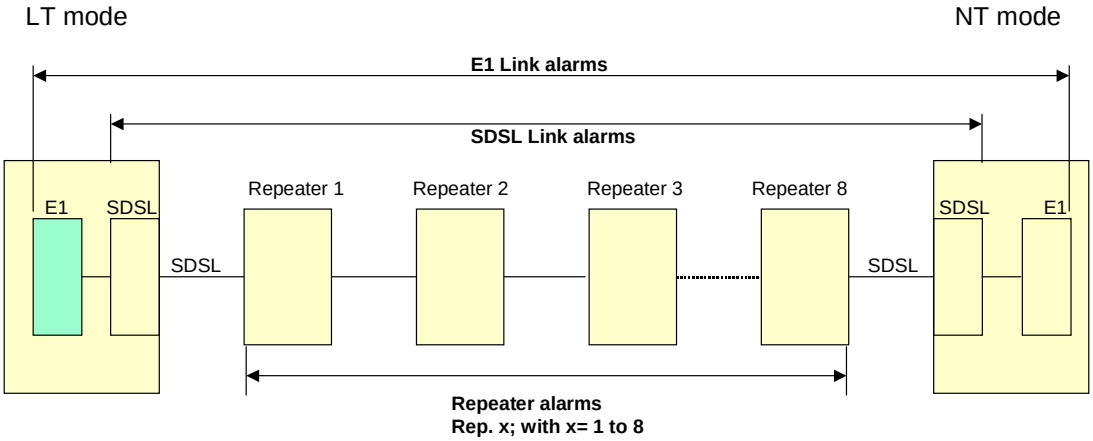


Figure 5.4: Loopbacks

5.7 Alarms

The following alarms are supported for signalling operating and error statuses:

- SDSL link alarms
- E1 link alarms
- Repeater alarms



5.7.1 SDSL link alarms

The following alarms (alarm no. 608 to 623 in the operator software) are supported for the SDSL link:

- Link: Configuration error
- Link: Wrong number of repeaters
- Link: Remote loop closed
- Link: No more PM resources available
- Link: LOS (Loss of Signal)
- Link: LOSWF (Loss Of Signal Word)
- Link: No Peer Detected
- Link: NT not identified
- Link: BER -5/6
- Link: BER -3
- Link: Segment error
- Link: SNR margin alarm
- Link: DiagnosticMode has been enabled by the user

5.7.2 E1 link alarms

The following E1 link alarms (alarm no. 624 to 631 in the operator software) are supported:

- Link E1: LOS (Loss of Signal)
- Link E1: AIS
- Link E1: LOF (Loss of Frame)
- Link E1: CRC4
- Link E1: BER -3
- Link E1: BER -5/6
- Link E1: D-bit received
- Link E1: N-bit received

Alarm suppression

Alarms detected	Suppressed alarms
LOS	LOF, CRC4, BER-3, BER-5/6, D-bit
AIS	LOF, CRC4, BER-3, D-bit
LOF	CRC4, BER-3, BER-5/6, D-bit
CRC4	BER-3, BER-5/6, D-bit
BER-3	BER-5/6
BER-5/6	-
DBit	-

5.7.3 Repeater alarms

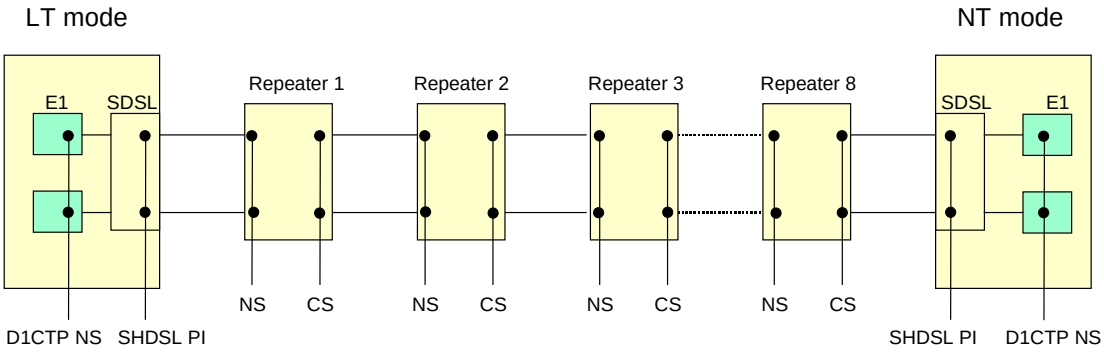
The following alarms (alarm no. 648 to 711 in the operator software) are supported by the SHDSL repeaters (max. 8) available on the SDSL link:

- Reg.x: Configuration error
- Reg.x: SNR margin alarm NS
- Reg.x: BER -5/6 NS
- Reg.x: LOS/LOF
- Reg.x: SNR margin alarm CS
- Reg.x: BER -5/6 CS
- Reg.x: SW/HW incompatibility
- Reg.x: Error during SW download

x = 1 to 8

5.8 Performance data

The following diagram shows the position of performance measuring points for the LT, NT and repeaters 1 to 8.



Definition of 15-min/24-h SDSL performance counters

Performance counter SDSL and repeater

Table 5.B: Performance counter SDSL and repeater

SHDSL PI	SHDSL REP	DESCRIPTION
COUNTER NAME		
TMP	TMP	Time of measurement period.
neES	neES	Count of Errored Seconds (ES) in this endpoint.
neSES	eSES	Count of Severely Errored Seconds (SES) in this endpoint.
neUS	neUS	Count of Unavailable Seconds (UAS) in this endpoint.
OI	-	Count of Outage Intensity events in this endpoint: State changes Available<->Unavailable
CRCA	CRCA	Count of CRC anomalies in this endpoint.
LOSWS	LOSWS	Count of Loss of Sync Word (LOSW) Seconds in this endpoint.
SEGA		Count of Segment anomalies in this endpoint.
LOS		Count of Loss Of Signal Seconds in this endpoint.

Performance counter E1

The E1 performance counters are used for the external E1 interfaces.

E1 PERFORMANCE COUNTER	DESCRIPTION
TMP	Time of measurement period
neUS	near end Unavailable Seconds (UAS)
neES	near end Errored Seconds (ES)
neSES	near end Severely Errored Seconds (SES)
neBBE	near end Background Block Errors

5.9 Online functions

The online functions of the operator software permit the following information to be requested for the ISHDSL module.

- Link State
  - Available Repeater Count [1 to 8]
  - Tip/Ring [reversed wires]
  - PSD Capability [symmetrical]
  - Transmission mode [ITU-T G.991.2 Annex B (Europe) (Region 2)]
  - Transmission mode Type Capability [only Region 2]
  - Clock [SHDSL Clock Mode 1 (plesiochronous)]
- Link Measurement Values
  - Loop Attenuation
  - SNR Value
  - Power Backoff
  - Tip/Ring (reversed wires)
- Interface Version (for each component of the link)
  - Active Software Version
  - Passive Software Version
  - Vendor Id
  - Vendor Model no.
  - Vendor Serial no.
  - Vendor EOC Software Version
  - SHDSL Version
  - Vendor List no.
  - Vendor Version no.
  - Equipment Code
  - Vendor other
- Firmware
  - Repeater firmware on SHDSL card
  - Active and passive firmware Id (SHDSL card and Repeater)
  - Load, request and activate firmware
- Restart
  - Restart the SHDSL link

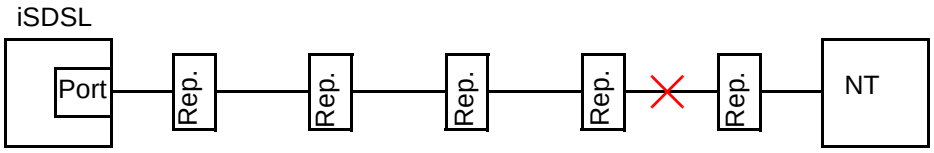
5.10 Diagnostic Mode

In order to startup the ISDSL port module with an LT initiated startup procedure the diagnostic mode has been established.

The repeater establishes the transmission line even if in downstream direction no NT or further Repeater is connected. Because this is no normal operation mode an alarm will be generated to inform the user.

Normally, an SDSL transmission line with several repeaters will be started after a NT is connected.

If the transmission line is interrupted a user cannot see where the interruption is located.



If the diagnostic mode is switched on (Configuration with ServiceOn XMP1) the transmission line will be activated even if no NT is connected. By the number of detected repeater it is possible to locate the section where the transmission line is interrupted (see Online Functions -> Link State -> Current Line State). This function should only be used for diagnostic purpose because it could lead to conflicts (e.g. simultaneously activation on the LT and NT side).

Additionally an alarm (Link: Diagnostic mode activated by user) appears in SOX if the diagnostic mode is activated

Chapter 6
ServiceOn XMP1 (SOX)

Nowadays network management plays an important role with regard to the operating costs of a system.

To meet today's requirements, Aastra offers with its ServiceOn XMP1 (SOX) a high-performance Network Management System for the XMP1 Cross-Connect Multiplexer.

Basically, the system is divided up as follows:

- Single-user application - Central management structure
- Multi-user application - Distributed management structure

6.1 ServiceOn XMP1 Element Manager (SOX)

The ServiceOn XMP1 software is available in two different versions:

1. SOX - LCT, as "Local Service PC" for on-site use on the XMP1 network element as substitute for the MSP equipment application.
2. SOX NMS, for configuration, control and monitoring of an XMP1 network.

The use of a dongle avoids unauthorized access to the network via the software. This dongle must be plugged onto one of the USB ports of the PC.

> **Note:** In the Multi-User version the dongle will be used only at the SOX Server PC.

The scope of functions of both versions is described below.

6.1.1 Local Craft Terminal SOX - LCT

Functions

The Local Craft Terminal SOX - LCT comprises the functions of the MSP (Modular SISA PC) and therefore permits a nearly complete configuration, commissioning and maintenance of a node.

The following functions are included:

- Complete node equipment
- Support of all previous XMP1 modules
- Complete configuration of all modules
- Configuration of all connection types possible
- Configuration of the most frequently used CC8 connections
- Configuration of clock priorities

- Support of the following online functions (operator functions):
  - Node status request
  - Firmware status request
  - Co-channel radio alignment
  - Loop switching
  - Line test
  - Debugging
  - RID data request
  - Setting of node passwords
  - Display of signal concentrator statuses and output control
- Reading out data from the node and file
- Saving data in the node and to file
- Reports for alarms, configuration
- Support of the signal concentrator card, display of signal statuses and manual control of the output relays

Data storage

A permanent data storage in a database is not supported here. The data saving function is supported. The node data are saved to an individual file in the XML (Extensible Markup Language) format.

System requirements

Hardware PC

Pentium 4, 1 GHz, at least 512 MB RAM, 60 GByte hard disk, serial interface

Operating system

Operating system PC with Windows XP Professional

6.1.2 SOX Network Manager SOX - NMS

Functions

The SOX Network Manager includes functions exceeding the Node Management functions. These permit the monitoring, control and configuration of a network.

Functionalities:

- Complete functionality of the Element Manager;
- Management of several sub-networks (areas);
- Management of several access points to an area;
- Connectivity Management
- Reports for alarms, configuration, cross-connections, trunks
- When a network element goes online, the alarm status of the node and the current configuration ID are requested automatically;
- A difference between the configuration IDs of the database and network element is displayed;
- Automatic routing;
- Automatic/manually rerouting at alarms
- Display of spontaneous alarms occurring in the network;
- Network-wide alarm management;
- Performance Management PDH/SDH
- Display of configured clock priorities in the network;
- Support of parallel firmware download to several nodes / areas;
- Storage of network data in the database;
- Integration of a (simple) help function;
- Implementation of network reactions: Control of signal concentrator outputs in consequence of signal concentrator inputs or alarms;
- Cyclical monitoring of network element configurations.

The following automatic control and monitoring functions have already been implemented:

- Display of spontaneous alarms;
- Node alarm status request when going online;
- Configuration status request when going online;
- Signal concentrator request when setting up a connection to the network;
- Network-wide cyclical monitoring of network element configurations.

Data storage

The data are stored on a permanent basis in the SQL database.

The selection of the MS SQL database server and database is supported.

The software supports the backup and restore function for the database; the SQL Enterprise Manager is not required. Copying, renaming and deleting of a database are supported.

The conversion of the data of the last version is supported.

System requirements

Hardware PC

- Pentium 4 Processor 2.8 GHz, 1024kB Cache
- 1,44 MB Floppy Drive,
- 1 GB RAM 533 MHz DDR Memory
- 48x CDRW/DVD Combo Drive
- 2* 73 GByte SCSI hard disk, 10.000U/min, Ultra320
- Partitioning
  C: System; D: Data; E: Backup
- Perc4 SC RAID PCI Controller 64MB U320
- Intel Pro/1000T Single Port Gigabit
- Logitech Scroll Mouse
- Keyboard
- free serial interface
- TFT-Monitor 20"

Operating system

- MS Windows Server 2003 Standard

Database

- MS SQL Server 2005

6.2 SOX Architecture

The Network Management System ServiceOn XMP1 (SOX) offers the following options for controlling and managing XMP1 networks.

- Single-user system
- Multi-user system

Both systems will be described in the following sections.

6.2.1 Single-user system

- For networks up to 100 nodes
- Management System SOX, MS Windows XP Pro and SQL Server 2000 Standard on one high-end PC
- Typically one user
- V.24/RS232 or TCP/IP connections to XMP1

Fig. 6.1 shows a typical single-user configuration.

The management connection of the XMP1 network is set up either via RS232 interface or Ethernet interface. The SOX-LCT is used for local operation and maintenance.

Sub-network/area

In this configuration, the XMP1 network consists of one sub-network referred to as area. In the course of the configuration process, all XMP1 nodes are assigned to this area. Within a sub-network (area), a node number must be assigned only once.

For connecting the network (area) to the SOX-NMS, an Access Point must be configured. The connection can be set up either via RS232 or TCP/IP.

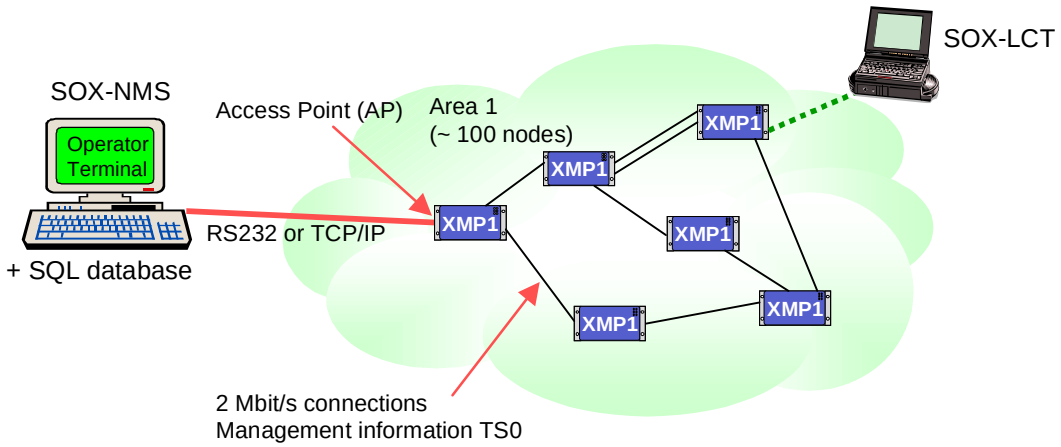


Figure 6.1: SOX single-user system, one area

Splitup into sub-networks

The XMP1 network can be split up into sub-networks (areas). These areas must be connected via Ethernet. For performance reasons, one area should not be assigned more than 70 nodes. In the Access Points to the individual areas, the Central Units (> Version 3.0) must be equipped with an additional module for IP connection.

The individual sub-networks (areas) still form the overall XMP1 network. However, each area has its own management access for SOX referred to as Access Point. A redundant management connection of the area via further Access Points is possible. In this case, Access Point priorities must be configured. Only the highest priority Access Point is active.

The management information is transmitted only inside an area in ECC8 of the system channel TS0 and not between the individual areas.

E1 connection between areas

Traffic data are still transmitted via E1 connections between the individual areas. The ECC8 in Sa-bits 7/8 of TS0 must not be transmitted between areas. For this reason, ECC8 transmission must be inhibited at the 2 Mbit/s interfaces of the E1 connection.

The transmission of the clock priority in Sa-bit 5 of TS0 can be adjusted in compliance with the clock concept.

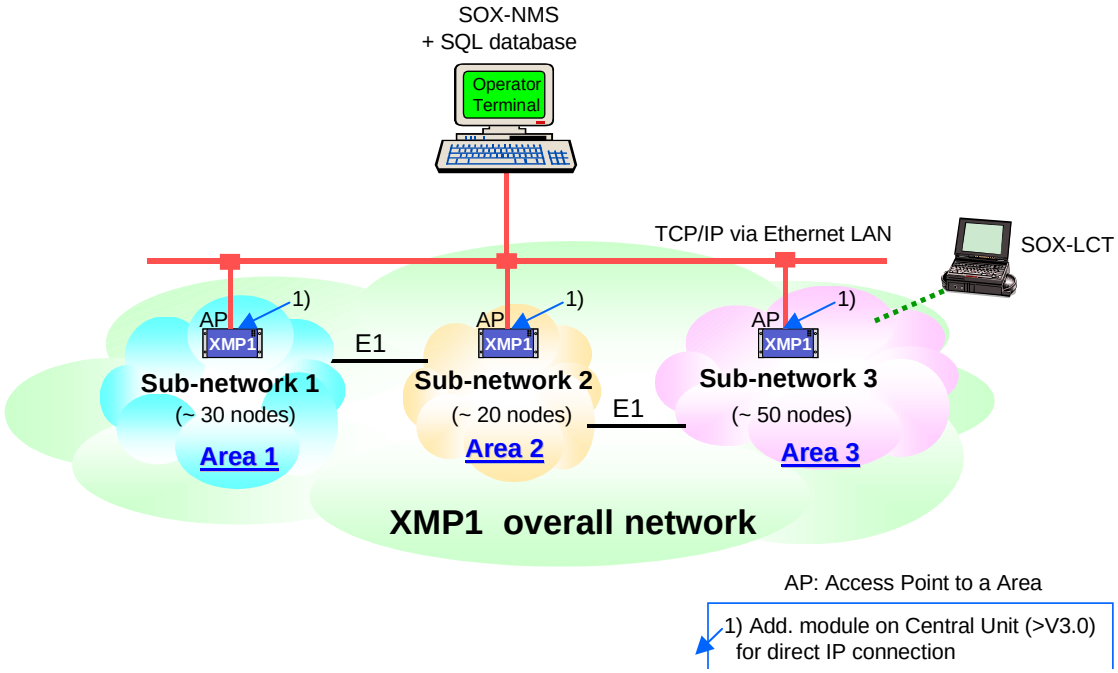


Figure 6.2: SOX single-user system, several areas

6.2.2 SOX Multi-User Version

6.2.2.1

The SOX multi-user version permits several users to access the database and XMP1 network simultaneously.

Supported scenarios:

- One user executes the configuration, while others use SOX as alarm monitoring station.
- One user with a low authorization level monitors the alarms. If required, another user with a higher authorization level intervenes.

With the SOX single-user version, only one PC can be connected to the XMP1 network. This primarily represents a network access restriction which only permits a TCP connection.
For the SOX multi-user version, the monolithic single-user application has be divided up into two parts:

- SOX Server
- SOX Clients

SOX Server (Kernel of a multi-user system)
The SOX Server (with SOXKernelService and SoxKernelConsole)) provides the link to the XMP1 network. It is connected to the Database Server and assumes central tasks. In a multi-user system, this SOX Server is required only once for each XMP1 network.
The SOX Server is installed on a Server PC with the Windows 2003 Server Multi-User Operating System. The Multi-User Operating System enables several users (up to 5 SOX Clients) to start a Windows user session on the Server PC. Normally, the Database Server is also on this Server PC. However, the Database Server can also be installed on another PC. The SOX Server and Database Server are implemented as Services at the "Windows Service Level".

SOX Client (PC of a multi-user system)
In conjunction with a SOX Server, the SOX Client is used to monitor and configure a XMP1 network. The SOX Client PC provides the user interface required for this purpose. It is possible to provide several SOX Clients. The SOX Client is started in a Windows user session. This Windows user session can be executed on the Server PC or a Client PC.

Both the SOX Server and SOX Client are using the common Database Server. The SOX Server receives - for example - alarms, saves these to the database and informs the SOX Clients. Using SOX Clients, it is possible to create new network elements in the database. In this case, the SOX Server is informed, updates its data from the database and forwards the corresponding information to the other SOX Clients.

The following diagram shows a logic view of the SOX multi-user system The SOX Client, SOX Server and Database Service communicate with each other via a TCP connection.

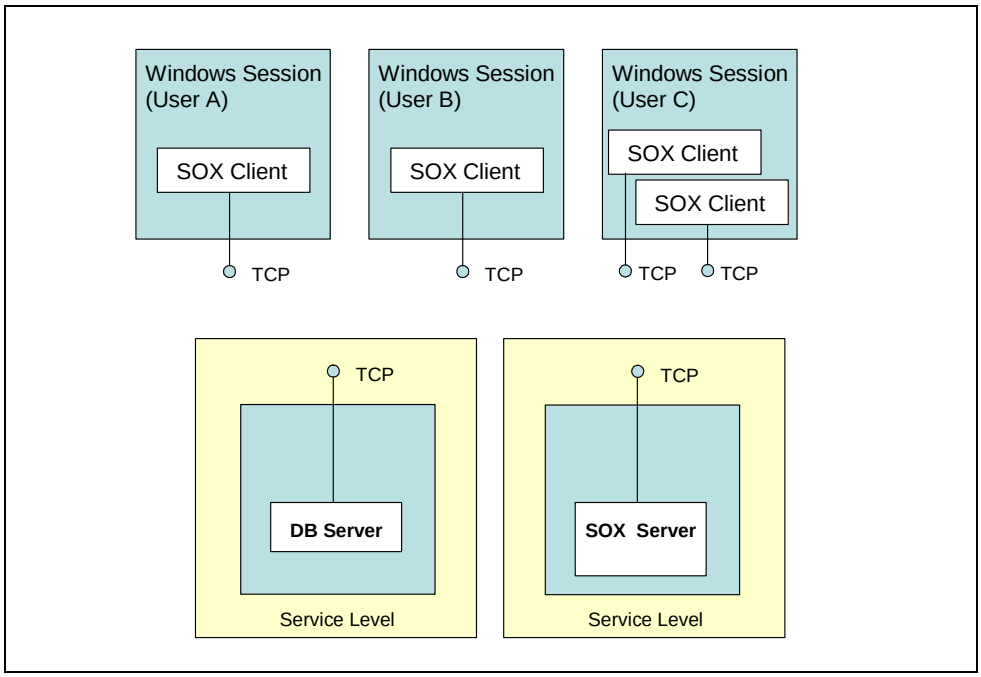


Figure 6.3: Logic view of the SOX multi-user system

Communication between the SOX Clients and SOX Server requires a quick and reliable TCP connection. Its use in a Wide Area Network (WAN) is not supported directly. For this purpose, another session must be started by an external PC for the Server PC using the "Remote Desktop" option. In this session, the SOX Client is locally run on the Server PC, while WAN traffic is handled by the "Remote Desktop".

The following drawing shows how the logic view depicted in Fig. 6.3 could be implemented in a hardware configuration. In this example, the SOX Server and Database Server are installed on one Server PC with the Windows Server 2003 Operating System. An external PC permits access via the "Remote Desktop" option. Two Client PCs also allow access to the XMP1 network.

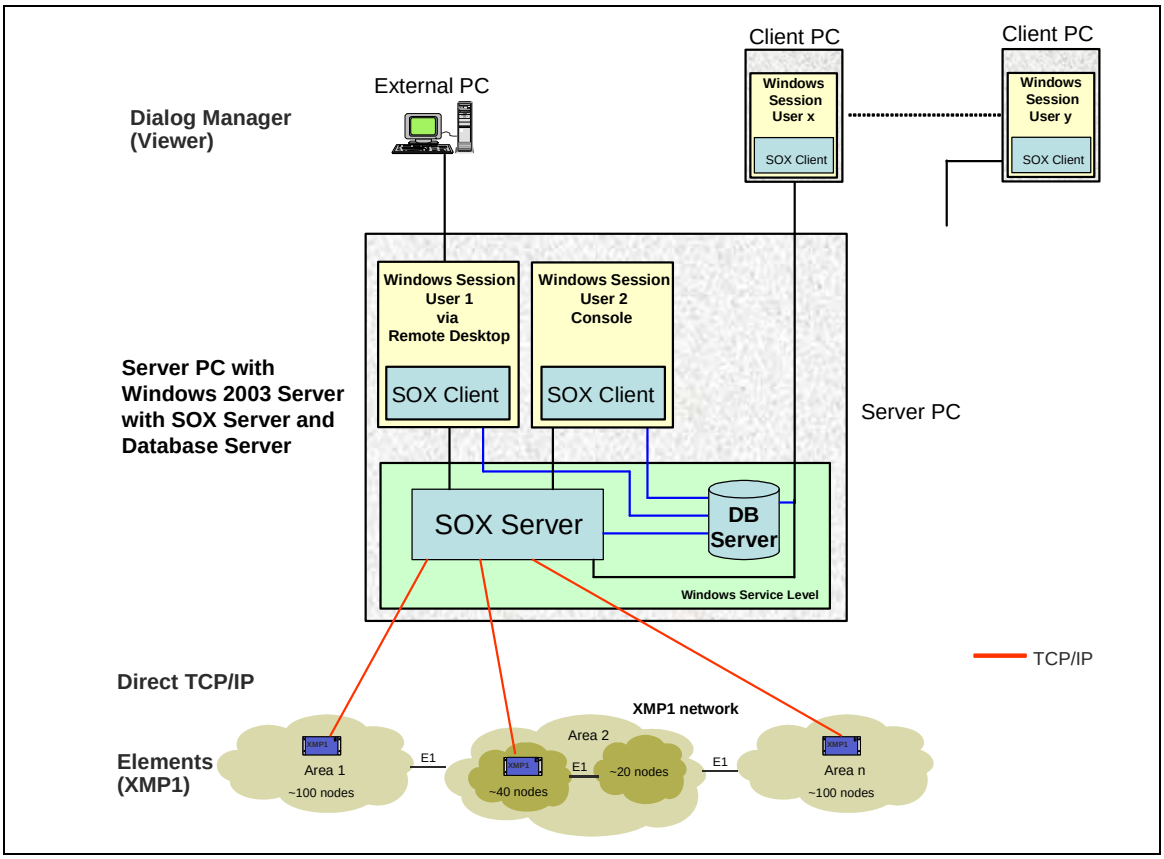


Figure 6.4: SOX Multi-user application, multiple areas

6.2.2.2 System Description

Assignment of Functions

SOX Server functions

The SOX Server sets up a connection to the XMP1 network and sends out messages to the network elements for the SOX Clients.
Incoming messages from network elements are passed on by the SOX Server to all SOX Clients.
The SOX Server receives alarms, stores them in the Database and advises the SOX Clients accordingly.
The SOX Server both executes alarm reactions and polls performance data.
Alarms stored in the Database are deleted or acknowledged by the SOX Server upon request and on behalf of a SOX Client.
The SOX Server holds the alarm status (red, green,…) of individual network elements, sub-addresses and functional units.
Information from a SOX Client regarding changes in the Database will be passed on by the SOX Server to all other SOX Clients connected.
SOX Clients can request exclusive access to the SOX Server. Only one SOX Client can have exclusive access at a time.
The SOX Server checks at regular intervals whether the connection to the SOX Clients is still existing.
The SOX Server informs the SOX Client on its software version and the

Database to be used.
In case of a connection of a new SOX Client, the SOX Server defines the authorization level of the SOX Client User and advises the SOX Client accordingly.

The SOX Server also checks whether a valid dongle (WIBU-KEY) is available.

SOX Client functions
The SOX Client checks whether the software version used is compatible with the one used by the SOX Server.
The SOX Client adapts its user interface to the user authorization level assigned and communicated by the SOX Server.
The SOX Client performs configuration changes. After these changes have been saved to the Database, the SOX Server will be advised accordingly. The SOX Server then informs all other SOX Clients on the changes made. If a SOX Client is advised that another SOX Client has changed the Database, it will inform its user and offer him a download of the updated data from the Database.
To send the configuration to the XMP1 network, the SOX Client will apply for exclusive access. Then the network element settings will be downloaded from the Database and converted into network element messages. These messages will be sent to the SOX Server from where they will be passed on to the individual network elements.
A software download is executed by the SOX Client. For this purpose, the latter must first apply for exclusive access. The SOX Client generates network element messages and sends them to the SOX Server.

6.2.2.3 Parallel Configuration

Using the current implementation, several SOX Clients may be able – under certain circumstances – to execute configuration work simultaneously. However, normal cases of application provide only

- one terminal for configuration and several terminals for monitoring purposes.

The "DataBaseServerMode" setting in the configuration file of the SOX Server determines whether the SOX Clients snynchronize their write accesses to the database via the SOX Server.

If the DataBaseServerMode adjusted is "Exclusive", only one SOX Client will get the configuration authorization (one configuration terminal, several monitoring terminals). "Exclusive" is the default setting for the DataBaseServerMode. If this setting is changed over to "Optimistic Concurrency", several SOX Clients will be able - under certain circumstances - to execute configuration work simultaneously.

All changes made by a SOX Client will be saved to the Database in one single transaction, i.e. either all changes or none of them will be saved.

SOX stores the original Database values. Before any changes will be saved to the Database, it is checked whether the Database still contains its original values. Only in this case, the changes will be executed (Optimistic Concurrency). Otherwise the action and thus the entire "Save" command will be rejected.

Each modification of the data of a network element will result in a change of the configuration ID.

This leads to the following situation:
Parallel configuration works are possible provided that these do not affect the same network elements and the same units at Network Manager level (circuits, trunks).

6.2.2.4 Load Behavior

SOX Client requests sent to the SOX Server are implemented synchronously, i.e. the SOX Client will be blocked until it receives an answer from the SOX Server (Timeout value can be entered in the configuration file).

SOX Server messages to the SOX Client are implemented asynchronously both in the SOX Server and SOX Client. Thus, a slow SOX Client cannot block the SOX Server. The SOX Server advises all SOX Clients asynchronously in new, separate threads.

The SOX Server checks at regular intervals whether a SOX Client is still addressable. If a communication error occurred in the connection to the SOX Client, the SOX Server will deregister the latter.

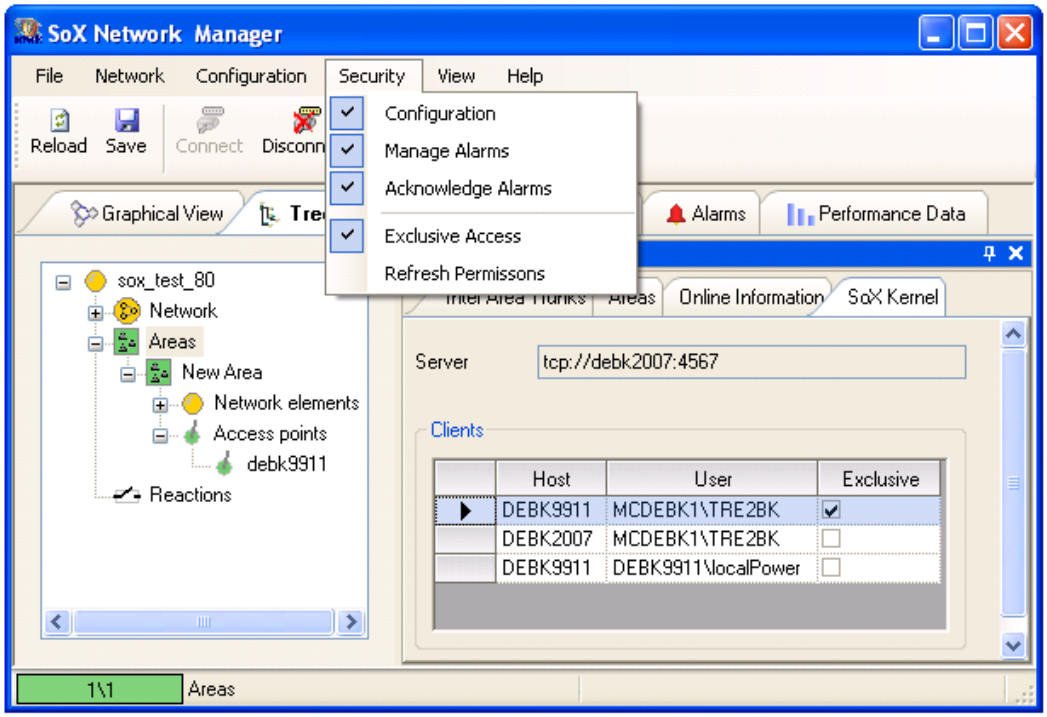
6.2.2.5 User Interface

In the "Properties" mask of the Area Node, an overview of all SOX Clients connected will now be displayed.

The "Security" menu offers the following additional items:

Exclusive Access
Apply for exclusive access

Refresh Permissions:
The authorizations of the User may have been changed in the SOX Server. This menu item permits the SOX Client to update its User Authorizations.



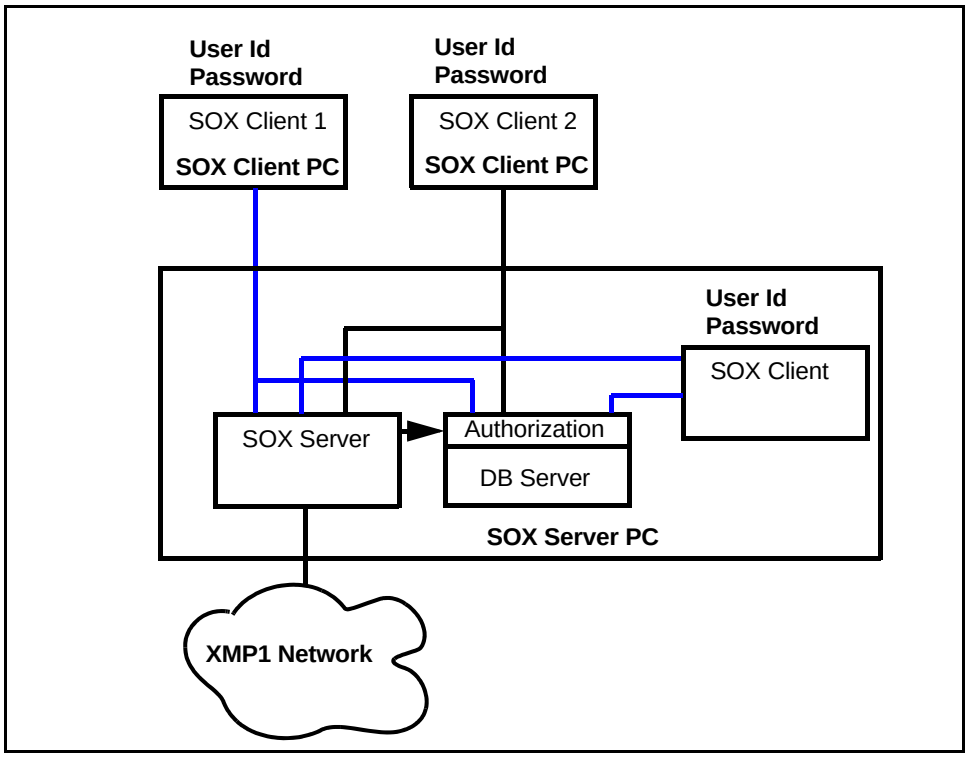
6.2.2.6 Safety

Authentication

Windows authentication

The authentication function checks the user identity. The user authentication is executed by Microsoft Windows by means of the user name and password. Windows requires each user to log on with the password and user name. A user logon normally takes place in the Windows domain, i.e. the individual users are know within this domain.

Note: The user identity detected within the Windows authentication process is used by the SOX Server and SOX Database as basis for the authorization check.

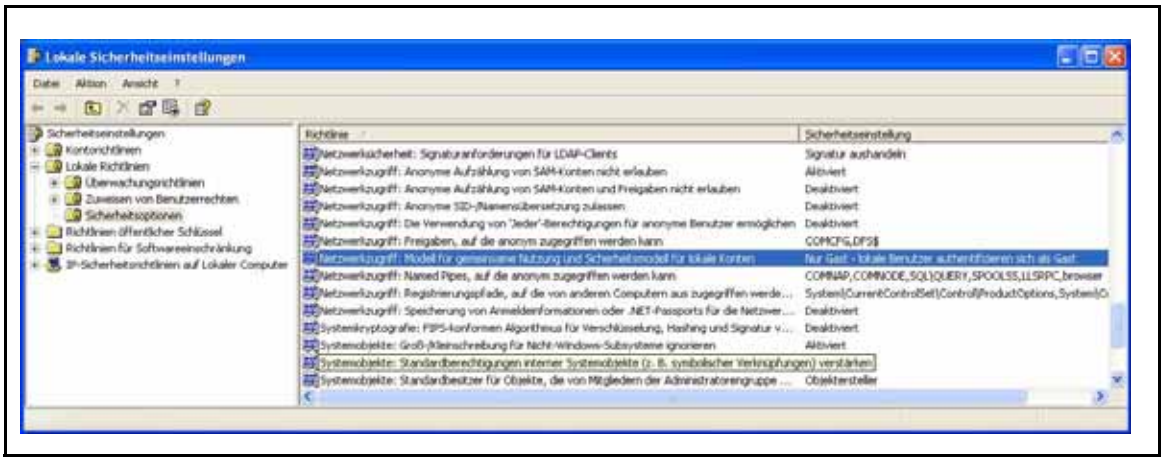


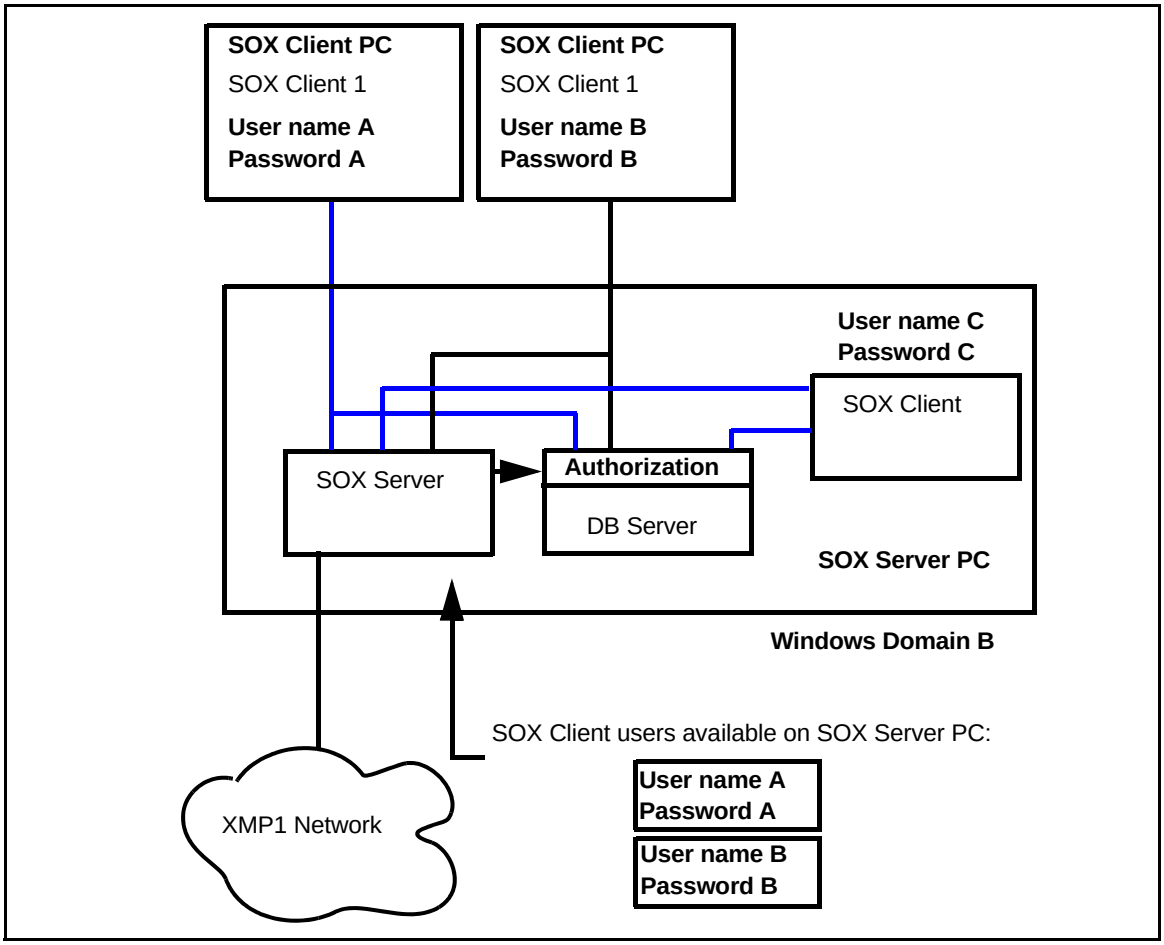
Authentication without Windows authentication

In applications where a Windows authentication cannot be used, the following requirements must be met:

- A user with the same name and same password must be available on both the SOX Client PC and SOX Server PC.
- On the SOX Server PC, the security "Network access: Model for commom use and security model for local accounts" must be set to the "Classical - Local users authenticate themselves as such" value.

  Note: With Windows XP, the basic setting is "Only guest: Local users autheticate themselves as guest". This setting must therefore be changed whenever the Server is run under Windows XP. For this purpose, call up Control Panel – Administrative Tools. Then click the Local Security Policy option and change the corresponding entry in Local Security Settings – Security Options.


Lokale Sicherheitseinstellungen
Datei Aktion Ansicht ?
Sicherheitseinstellungen
Kontorichtlinien
Lokale Richtlinien
Überwachungsrichtlinien
Zuweisen von Benutzerrechten
Sicherheitsoptionen
Richtlinien öffentlicher Schlüssel
Richtlinien für Softwareeinschränkung
IP-Sicherheitsrichtlinien auf Lokaler Computer
Richtlinie
Sicherheitseinstellung
Netzwerksicherheit: Signaturanforderungen für LDAP-Clients
Signatur aushandeln
Netzwerkzugriff: Anonyme Aufzählung von SAM-Konten nicht erlauben
Aktiviert
Netzwerkzugriff: Anonyme Aufzählung von SAM-Konten und Freigaben nicht erlauben
Deaktiviert
Netzwerkzugriff: Anonyme SID-/Namensübersetzung zulassen
Deaktiviert
Netzwerkzugriff: Die Verwendung von 'Jeder'-Berechtigungen für anonyme Benutzer ermöglichen
Deaktiviert
Netzwerkzugriff: Freigaben, auf die anonym zugegriffen werden kann
COMCFG,DFS$
Netzwerkzugriff: Modell für gemeinsame Nutzung und Sicherheitsmodell für lokale Konten
Nur Gast - lokale Benutzer authentifizieren sich als Gast
Netzwerkzugriff: Named Pipes, auf die anonym zugegriffen werden kann
COMNAP,COMNODE,SQL\QUERY,SPOOLSS,LLSRPC,browser
Netzwerkzugriff: Registrierungspfade, auf die von anderen Computern aus zugegriffen werde...
System\CurrentControlSet\Control\ProductOptions,System\C
Netzwerkzugriff: Speicherung von Anmeldeinformationen oder .NET-Passports für die Netzwer...
Deaktiviert
Systemkryptografie: FIPS-konformen Algorithmus für Verschlüsselung, Hashing und Signatur v...
Deaktiviert
Systemobjekte: Groß-/Kleinschreibung für Nicht-Windows-Subsysteme ignorieren
Aktiviert
Systemobjekte: Standardberechtigungen interner Systemobjekte (z. B. symbolischer Verknüpfungen) verstärken
Systemobjekte: Standardbesitzer für Objekte, die von Mitgliedern der Administratorengruppe ...
Objektersteller


SOX Client PC
SOX Client 1
User name A
Password A
SOX Client PC
SOX Client 1
User name B
Password B
User name C
Password C
SOX Client
SOX Server
Authorization
DB Server
SOX Server PC
Windows Domain B
SOX Client users available on SOX Server PC:
User name A
Password A
User name B
Password B
XMP1 Network

Authorization

Authorization means that the program identifies as to which authorizations a user has and which actions the individual users may execute.

> **Note:** The user identity detected within the Windows authentication process is used by the SOX Server and SOX Database as basis for the authorization check.

The user authorizations are always verified in the Database Server independently of the authorization check performed in the SOX Server.

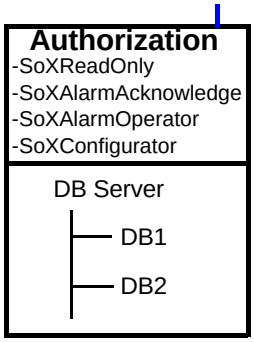
For the SOX Server, an authorization check can be configured optionally by means of the Microsoft Authorization Manager (AzMan). The default setting does not provide such an authorization check for the SOX Server.

SQL Database Server

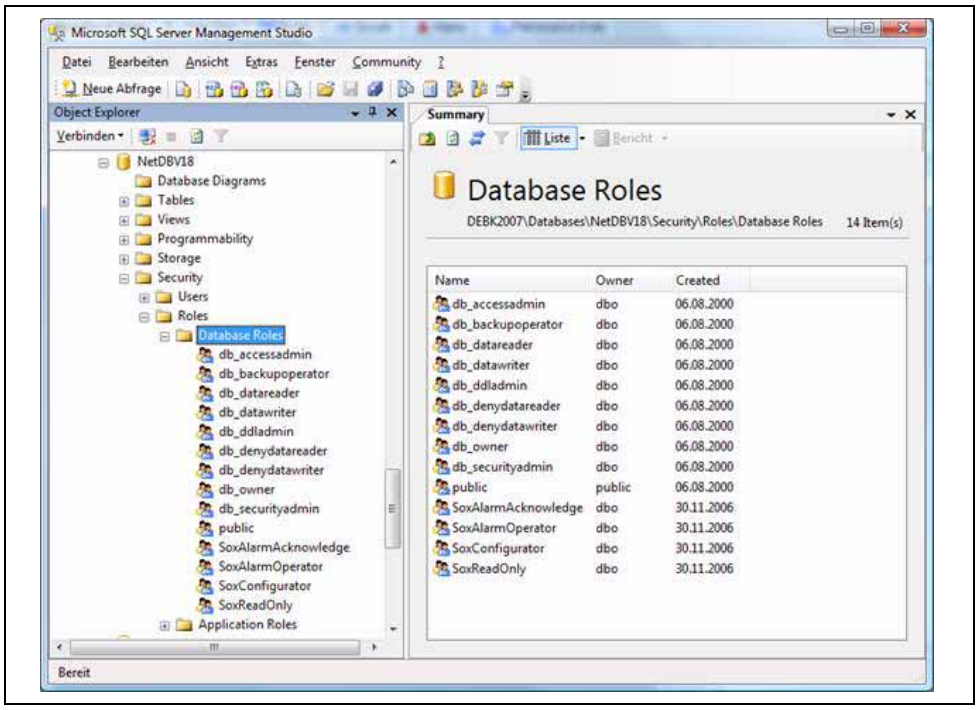
For each action, the SQL Database Server checks as to which authorization the corresponding user has for an SOX Database. In a SOX Database, four roles with predefined authorizations are already configured.

These roles will then be assigned users or groups.

In case of an access to the Database Server, this assignment is used to check the user's authorization.



SoXReadOnly	The user has read-only access to the Database.
SoXAlarmAcknowledge	The user can also acknowledge alarms.
SoXAlarmOperator	The user can also delete alarms and performance data.
SoXConfigurator	The user can also change the configuration.



SOX Server

In the default configuration, an authorization check is not executed in the SOX Server. Each user has all rights.

Optionally, it is possible to activate a check for user rights in the SOX Server. This is done via the configuration file or command line parameters. ’

See Section , *SOX Server side* . -> SecurityMode = azman.
In this case, the SOX Server uses the Microsoft Authorization Manager (AzMan).

The Microsoft Authorization Manager (AzMan) supports a role-based security model. Using the Microsoft Authorization Manager, an own authorization system will be implemented in the SOX Server.

This authorization system (AzMan) then uses the roles to check the actions the SOX Client user may execute.

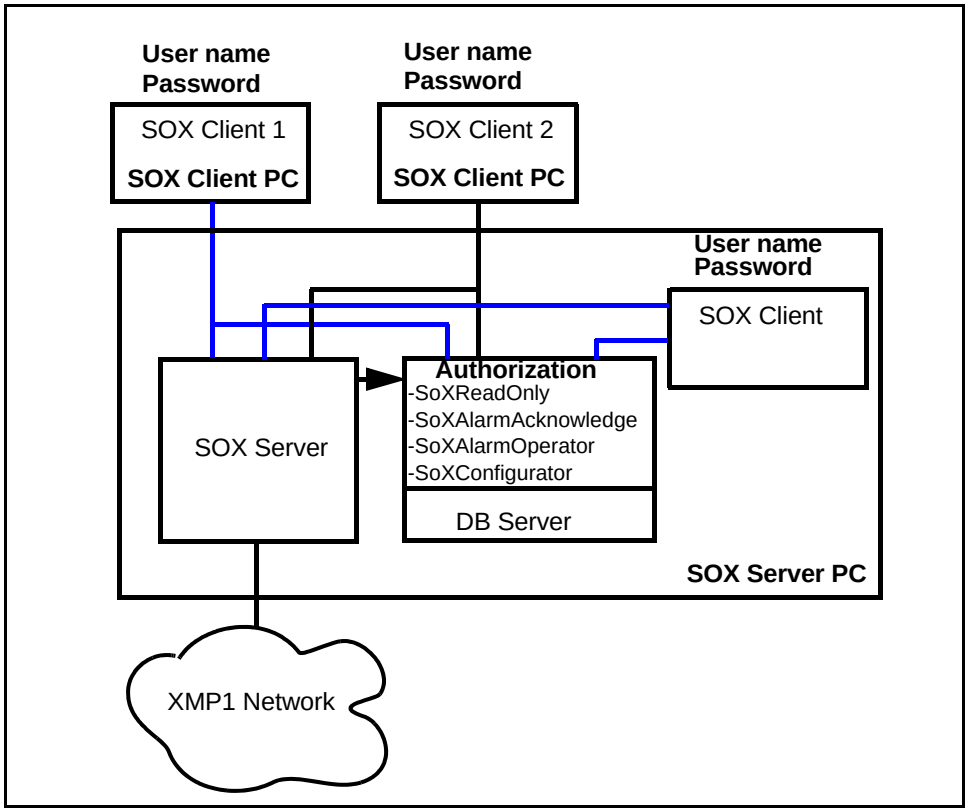
Using the authorization system (AzMan), users not authorized are prevented from sending data into the XMP1 network, e.g. starting a software download.

> **Note:** The authorization system of the Database Server remains active and controls database access. Each SOX user must be assigned appropriate authorizations in the database.

Authorization without AzMan

If the Windows Authorization Manager (AzMan) is not used, all users are authorized to send data to the XMP1 network.

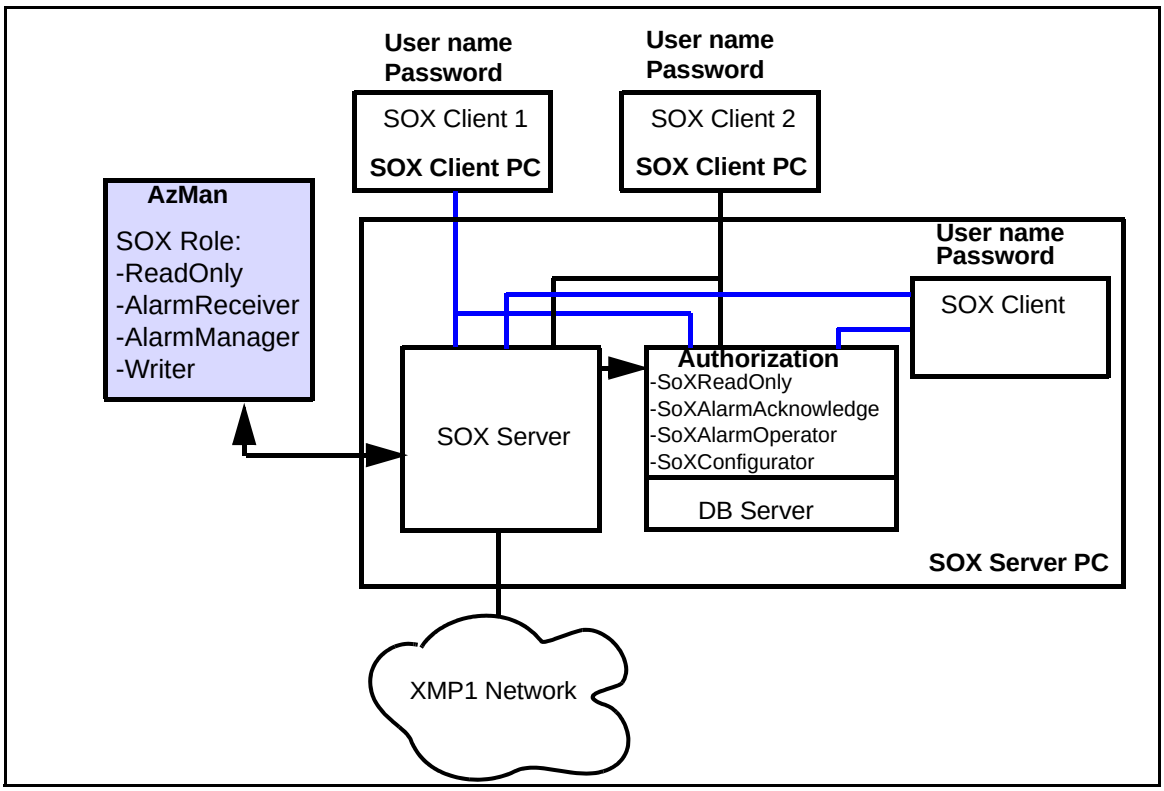
The default setting for the "SecurityMode" is "none", i.e. authorization without "azman".



Authorization with AzMan

The authorization setting with "azman" is made in the configuration file using the "SecurityMode".
To use the Authorization Manager, the "SecurityMode" must be set to "azman".

With "AzMan", the SOX Server uses the Microsoft Authorization Manager to check the authorizations of SOX Client users. Thus, users not authorized are prevented from accessing the network.



Roles

In multi-user operation, different users with different system authorizations are normally involved.

The existing implementation distinguishes between four different roles. Each Authorization Manager role can be assigned users or user groups.

Tab. 6.A: Roles (AzMan)

PC	Network Management: Menu: Security	SOX role in the Authorization Manager (AzMan) *	Possibilities
Monitoring PC	none (read-only rights)	ReadOnly	The configuration and alarms can be viewed, but not changed.
Alarm monitoring PC	Acknowledge alarms	AlarmReceiver	Besides read-only rights, the user can also acknowledge alarms.
Surveillance PC	Alarm management	AlarmManager	Alarms can additionally be deleted.
Configuration PC	Configuration	Writer	Highest user level with read and write access to the overall system.
* optional application			

Note: The use of the Authorization Manager in SOX represents an option. Without the Authorization Manager, each user has full read and write access to the SOX Server.

The Authorization Manager is an integrated part of the Windows 2003 Server. For Windows XP, the Windows Server 2003 Administration Tools Pack can be installed.

The Authorization Manager is used optionally only by the SOX Server. PCs running only the SOX Client do not require the Authorization Manager. With the Windows 2003 Server, the Authorization Manager can be started as follows:

Start – Execute – azman.msc

Note: With Windows XP, the "Local System" user cannot correctly run the Microsoft Authorization Manager with an XML memory. In this case the SoXKernelService should be run under a normal user account. This restriction does not exist with the Windows 2003 Server.

6.2.2.7 User Administration

SOX users are allocated to certain **Windows User Groups** depending on the authorization levels provided for them in the SOX. These Windows User Groups are used by the SOX Server and SQL Database Server to carry out the authorization check.

These Windows User Groups are entered in the **SQL Database Server** as SQL Server Logons. For each SOX Database, database users must be defined. These SOX Database Users will then be assigned database roles.

In the **SOX Server** standard configuration, the authorization check is not provided, i.e. each user has all rights.
However, it is possible to configure the **Windows Authorization Manager (AzMan)** as an option. In this case, an authorization check controlling access to the SOX Server will be performed. In the Windows Authorization Manager (AzMan), the Windows User Groups must then also be assigned SOX roles.

> **Note:** The Windows Authentication function is used to authenticate the SOX users.

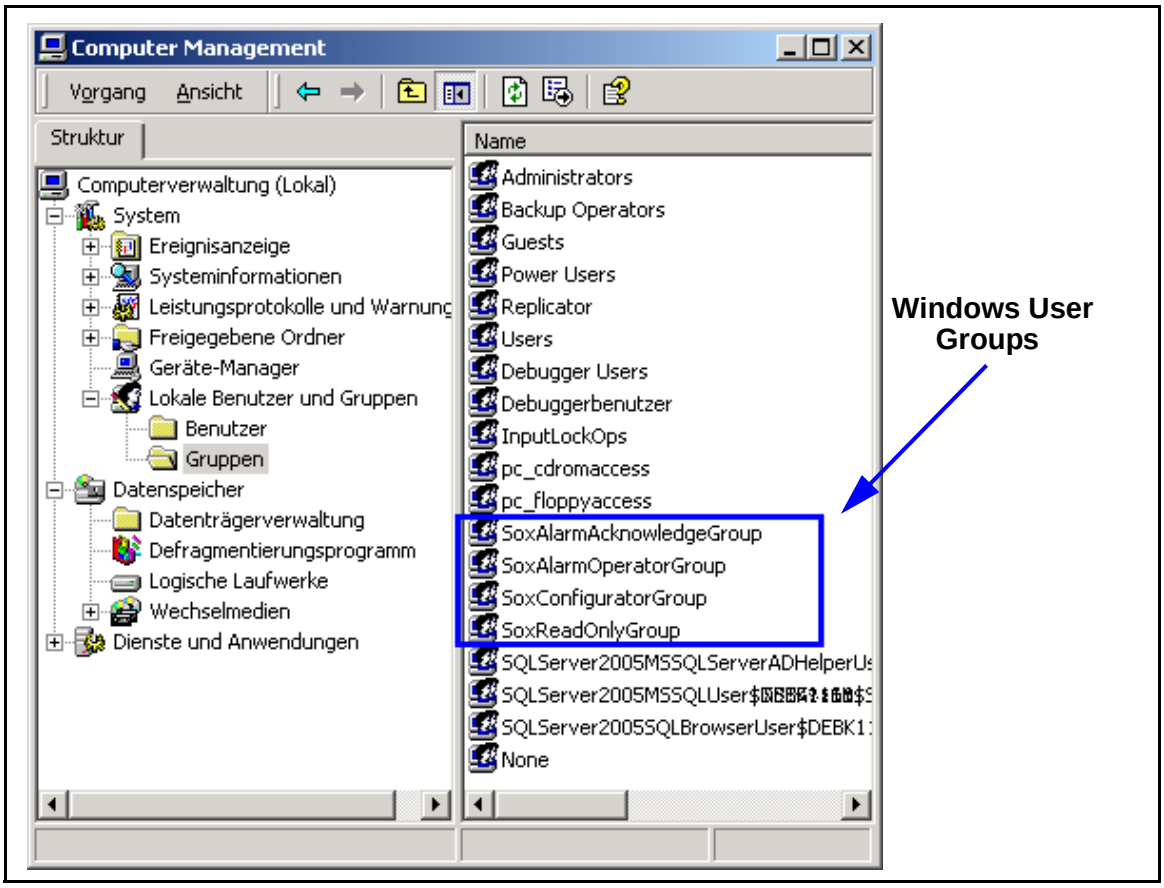
> **Note:** The Remote Desktop Session enables a user of an external PC (without SOX Client Installation) to start a SOX Client on a Server PC. The user accessing the Server PC via a Remote Desktop Session must have been entered in Windows as "Remote Desktop User".

Windows User Groups

Four Windows User Groups are pre-configured on the Server PC. Depending on their SOX authorizations, the Windows Users are allocated to these Windows User Groups.

Tab. 6.B: Allocation of Windows User Groups to SOX authorizations

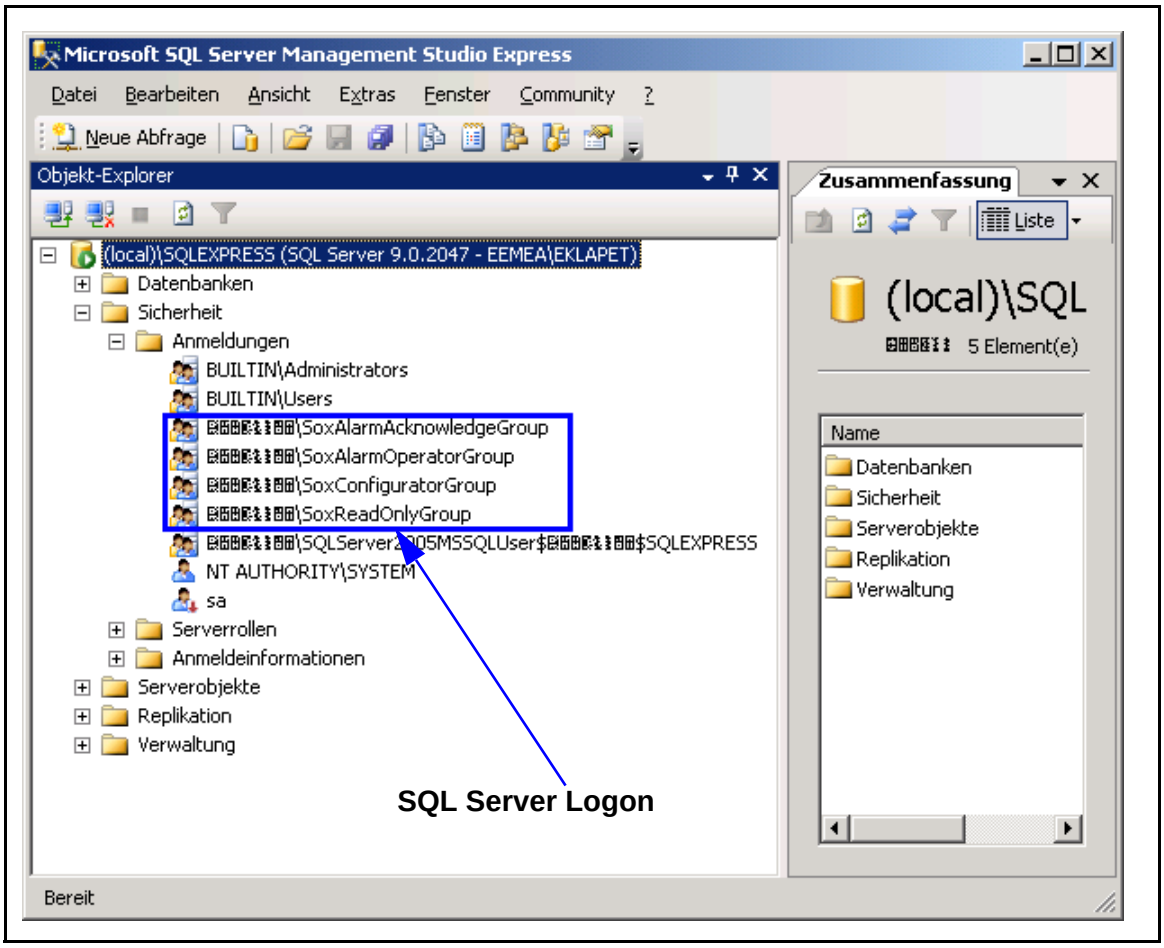
WINDOWS USER GROUP	USER RIGHTS IN THIS GROUP
SoxReadOnly	The user has read access to the Database.
SoxAlarmAcknowledge	The user can also acknowledge alarms.
SoxAlarmOperator	The user can also delete alarms and performance data.
SoxConfigurator	The user can also enter and change configuration data.



SQL Database Server

SQL Server logon

In the SQL Database Server, a SQL Server logon is configured for each of the four Windows User Groups existing. This SQL Server logon is used to define as to which Windows User or User Group can access the SQL Database Server.



Database users

The database users to be granted access to the SOX database must be entered in the latter. Furthermore the database users must also be assigned database roles. These define the authorization level of a database user when accessing the database. This allocation must be performed for each database used.

The following database users must be entered with the appropriate database roles:

DATABASE USER		DATABASE ROLE
Computername\SoxReadOnlyGroup	--->	SoxReadOnly
Computername\SoxAlarmAcknowledgeGroup	--->	SoxAlarmAcknowledge
Computername\SoxAlarmOperatorGroup	--->	SoxAlarmOperator
Computername\SoxConfiguratorGroup	--->	SoxConfigurator

Fig. 6.5 gives an overview of user groups and their role assignment.

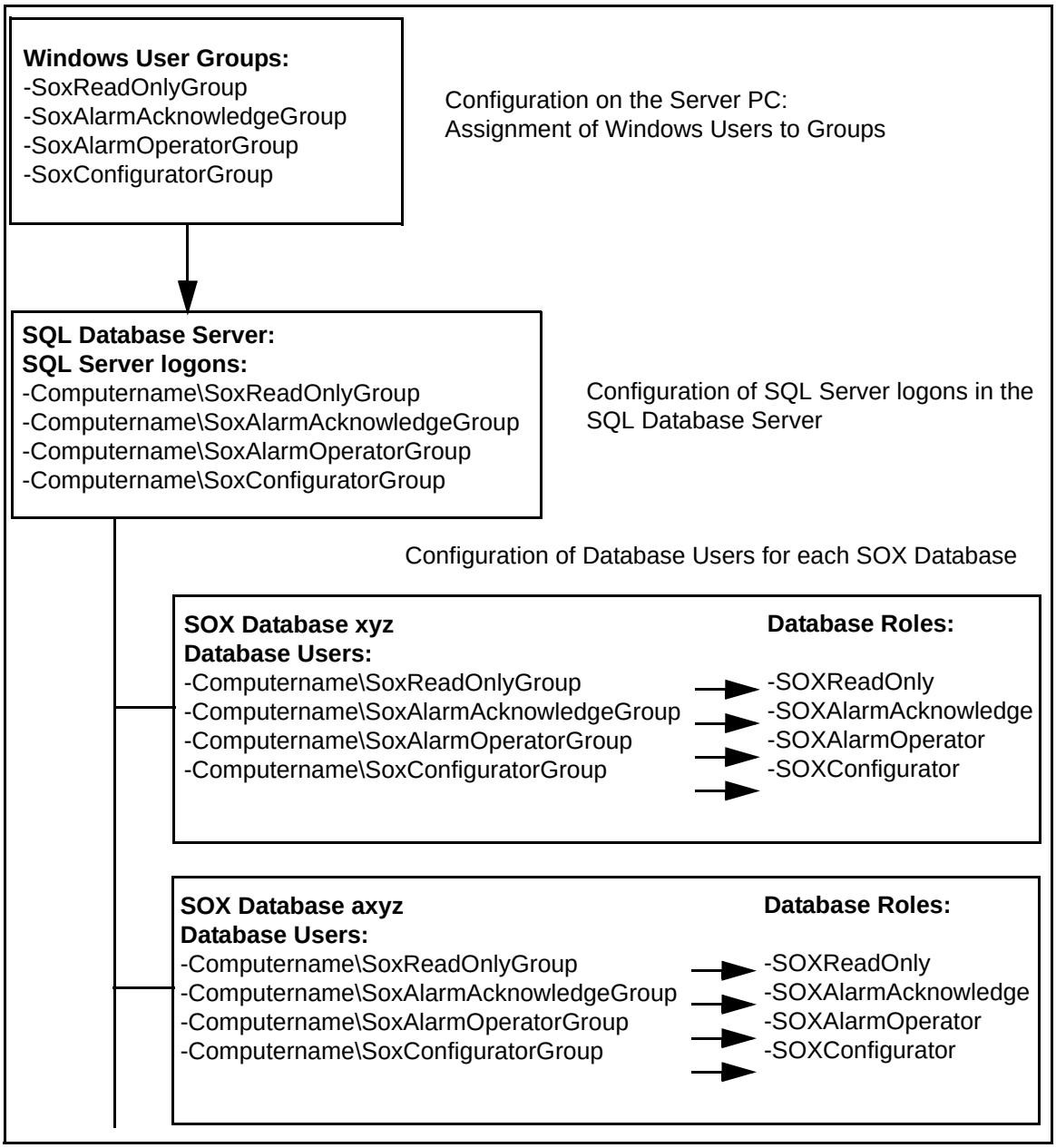


Fig. 6.5: Overview of User Groups and Role Assignments

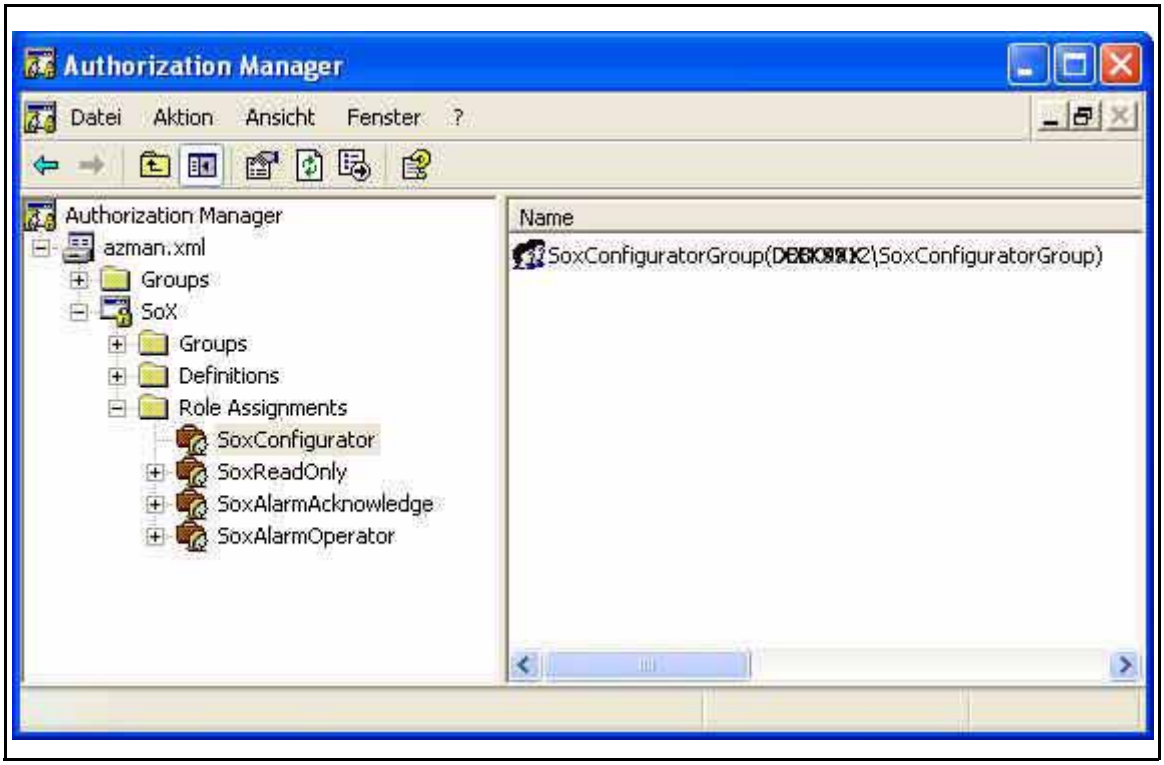
Authorization Manager (AzMan)

The Microsoft Authorization Manager (AzMan) supports a role-based security model. Using the Authorization Manager, an own authorization system is implemented in the SOX Server.

If the Microsoft Authorization Manager is used to check the authorization of the SOX Server, the Windows Users/User Groups must be assigned to the predefined SOX roles in the Microsoft Authorization Manager. This can be done by means of the **azman.xml** file. This file is located in the SOX installation directory.

Tab. 6.C: Assignment of SOX Roles to SOX Windows User Groups

SOX ROLES	DESCRIPTION		PREDEFINED SOX WINDOWS USER GROUP
SoxReadOnly	The user can read only.	--->	SoxReadOnlyGroup
SoxAlarmAcknowledge	The user can also acknowledge alarms.	--->	SoxAlarmAcknowledgeGroup
SoxAlarmOperator	The user can also delete and alarms performance data.	--->	SoxAlarmOperatorGroup
SoxConfigurator	The user can also enter and change configuration data.	--->	SoxConfiguratorGroup



6.2.2.8 Installation

The SOX Setup copies the files required for the Client, Server and Single-User Version into the installation directory. This directory should contain three *.exe files:

Aastra.Sox.SoxKernelService.exe	SoX Server as Windows Service – must be installed as Windows Service using the installutil.exe auxiliary program before being used.
Aastra.Sox.SoxKernelConsole.exe	SoX Server as Console Application – with the same command line parameters and a configuration file similar to SoxKernelService.exe.
Aastra.Sox.SoxUserInterface.exe	SoX Single User NMS, with the –Client option: SoX Client, with –LCT option: SoX LCT

SoxKernelService.exe runs as Windows Service. It is started as Windows Service and sets up a connection to the XMP1 network immediately, i.e. before a user logs in. It continues to run even after the last user has logged out.

Since this program does not have a User Interface, it retrieves its parameters from configuration files or from the command line parameters. Possible alarm messages will appear in the Windows Event Display. Parameterization via the configuration file must be separately executed for each installation.

SoxKernelConsole.exe has the same command line parameters and a configuration file similar to that of SoXKernelService.exe. Before SoxKernelService.exe is installed as Windows Service, the settings of the configuration files or command line parameters can be checked by means of SoXKernelConsole.exe.

SoxUserInterface.exe provides the User Interface of the SOX Client. Using the -Client option, the SOX single-user NMS is started as SOX Client. Using the -LCT option, the SOX single-user NMS is started as SOX LCT.

For detailed information, please refer to the installation instructions.

6.2.2.9 Configuration

Configuration files

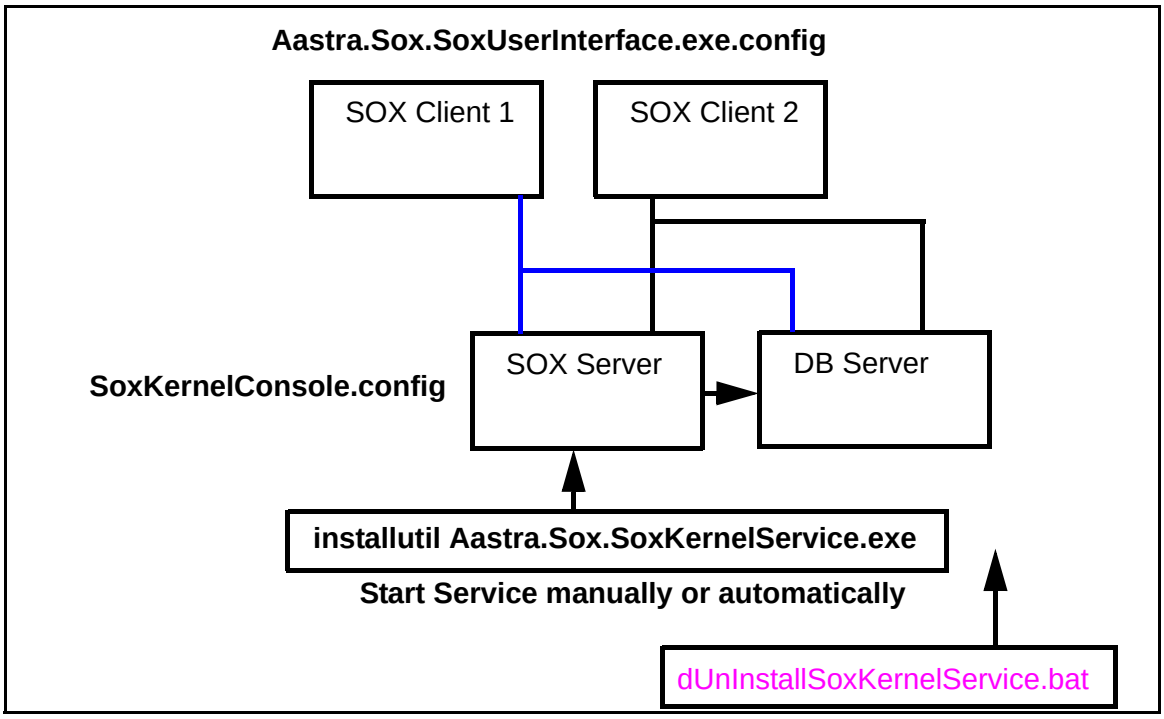
The configuration of the SOX multi-user version takes place with the installation using configuration files. The configuration files required for the SOX Server and SOX Client are different. In these configuration files, startup settings are defined for the SOX Server and SOX Client. The configuration files are located in the SOX installation directory. The names of the configuration files are identical with those of the executable program (**.exe**). However, they are ending with the **.config** suffix.

Aastra.Sox.SoxUserInterface.exe	Aastra.Sox.SoxUserInterface.config
Aastra.Sox.SoxKernelService.exe	Aastra.Sox.SoxKernelService.config
Aastra.Sox.SoxKernelConsole.exe	Aastra.Sox.SoxKernelConsole.config

The SoxKernelService (SOX Server) is implemented as Service at the Windows Service level and configured for Windows using the "**installutil Aastra.Sox.SoxKernelService.exe**" file.

The start behavior of this Service is defined via the Control Panel/Administrative Tools/Services option in the "Properties" window of the SoxKernelService. The startup behavior can be set to manual or automatic.

Using the "**installutil /u Aastra.Sox.SoxKernelService.exe**" file, SoxKernelService can be deinstalled.



SOX Server side

SoxKernelConsole.config file

In the „Remoting“ section, the communication channels and Server Services will be specified.

```
<system.runtime.remoting>
  <application>
    <channels>
      <channel ref="tcp" port="10567" secure="true" protectionLevel="none" >
                <serverProviders>
                    <formatter ref="Binary" typeFilterLevel="Full"/>
                </serverProviders>
                <clientProviders>
                    <formatter ref="Binary"/>
                </clientProviders>
        </channel>
  </channels>
  <service>
      <wellknown mode="Singleton" type="Aastra.Sox.RemotingSupport.RemoteSoxKernel,Aastra.Sox.RemotingSupport"
            objectUri="SoxKernel.rem"      />
      <wellknown mode="SingleCall" type="Aastra.Sox.RemotingSupport.CompatibilityInfoServer,Aastra.Sox.RemotingSupport"
            objectUri="SoxCompatibilty.rem"      />
  </service>
```

In the configuration file, only values regarding the TCP channel entry should be changed.

<channel ref="tcp" port="10567" secure="true" protectionLevel="none" >

Port	The „**port**“ attribute specifies the TCP port to be opened by the SOX Server.
Secure	The **„Secure“**attribute can have the values **„true"** or **„false"**. If it is set to **„true"**, the user of the TCP channel will be authenticated, i.e. the SOX Server knows under which Windows User Account the SOX Client is run. This is the prerequisite for the security concept of the SOX Server. If the user cannot be authenticated, the connection will not be set up. If **„secure"** is set to **„false"**, the SOX Server will not carry out any check (the Database Server will continue to check).
ProtectionLevel	The **„ProtectionLevel“** attribute is applicable only in case of a "secure" connection and indicates as to whether messages shall be encrypted for transmission or not. Possible values are "**none**", i.e. transmission without encrytion or **„EncryptAndSign“**, i.e. transmission with encyrption.

The Start parameters of the Server are indicated in the <application settings> section.

```
<applicationSettings>
  <Aastra.Sox.SoXKernelConsole.Settings1>
   <setting name="DataBaseServer" serializeAs="String">
    <value>(local)</value>
   </setting>
   <setting name="DataBaseName" serializeAs="String">
      <value>sox_dataBase</value>
   </setting>
   <setting name="KernelSupervisonMinutes" serializeAs="String">
    <value>10</value>
   </setting>
   <setting name="ImpersonateClients" serializeAs="String">
    <value>True</value>
   </setting>
   <setting name="SecurityMode" serializeAs="String">
    <value>Azman</value>
   </setting>
   <setting name="AzmanStore" serializeAs="String">
    <value>msxml:azman.xml</value>
   </setting>
  </Aastra.Sox.SoXKernelConsole.Settings1>
 </applicationSettings>
```

DataBaseServer	Specifies the Database Server.
DatabaseName	Specifies the Database in the Database Server.
KernelSupervisonMinutes	Specifies the time (in minutes) after which the SOX Server will check whether the connection to its SOX Clients is still existing.
ImpersonateClients	Defines the behavior of the SOX Server on entry of the commands "Delete alarms" or "Acknowledge alarms". These commands are sent by the SOX Clients to the SOX Server. The SOX Server then executes the corresponding changes in the Database. If „**ImpersonateClients**“ is set to „**true**", these actions will be executed under the SOX Client's User Account, i.e. the Database Server will check the authorization of the Client User. If ImpersonateClients is set to "**false**", the changes in the Database will be carried out under the User Account of the Server. If the SOX Server has set „**ImpersonateClients**“ to "**true**", the SOX Client must authorize the SOX Server to execute actions on its behalf. This can be done in the SOX Client configuration file.
SecurityMode	Can be set to the possible values "**Azman**" or "**None**". With "**Azman**", the SOX Server will use the Microsoft Authorization Manager to check the authorizations of the SOX Client User.
AzmanStore	Describes as to where the SOX Server will find the authorization storage of the Authorization Manager. Examples of possible AzmanStore paths: · msxml://c:/abc/test.xml · msxm://\\server\share\abc.xml · msxm://d|/dir1/dir2/abc.xml · msxm://c:/Documents%20and%20Settings/test%2exml

SOX Client Side

SoxUserInterface.exe.config file

On the SOX Client side, the communication channel to the SOX Server must be described in the configuration file (Aastra.Sox.SoxUserInterface.exe.config). The SOX Server in turn directly informs the SOX Client on the Database used.

```
<system.runtime.remoting>
  <application>
    <channels>
      <channel ref="tcp" port="0"  secure="true" protectionLevel="none"
        tokenImpersonationLevel="Impersonation" timeout="60000">
        <formatter ref="binary" typeFilterLevel="Full" />
      </serverProviders>
      <clientProviders>
        <formatter ref="Binary"/>
      </clientProviders>
    </channel>
  </channels>
  <client>
    <wellknown type="Aastra.Sox.KernelInterfaces.ISoxKernel, Aastra.Sox.KernelInterfaces"
      url="tcp://localhost:10567/SoxKernel.rem"/>
    <wellknown type="Aastra.Sox.KernelInterfaces.ISoxCompatibility, Aastra.Sox.KernelInterfaces"
      url="tcp://localhost:10567/SoxCompatibilty.rem"/>
  </client>
</application>
</system.runtime.remoting>
```

url	The two "**url**" attributes are used to indicate as to where the services of the SOX Server can be found. If the SOX Server is not run on the same PC as the SOX Client, "localhost" must be replaced by the hostname or IP address of the Server PC. The colon is followed by the TCP port number of the SOX Server. It must be identical with the port number specified in the SOX Server configuration file. The parameters entered as communication channel attributes should also be identical betweeen the SOX Client and SOX Server.

```
<channel ref="tcp" port="0"  secure="true" protectionLevel="none" tokenImpersonationLevel="Impersonation" timeout="60000">
```

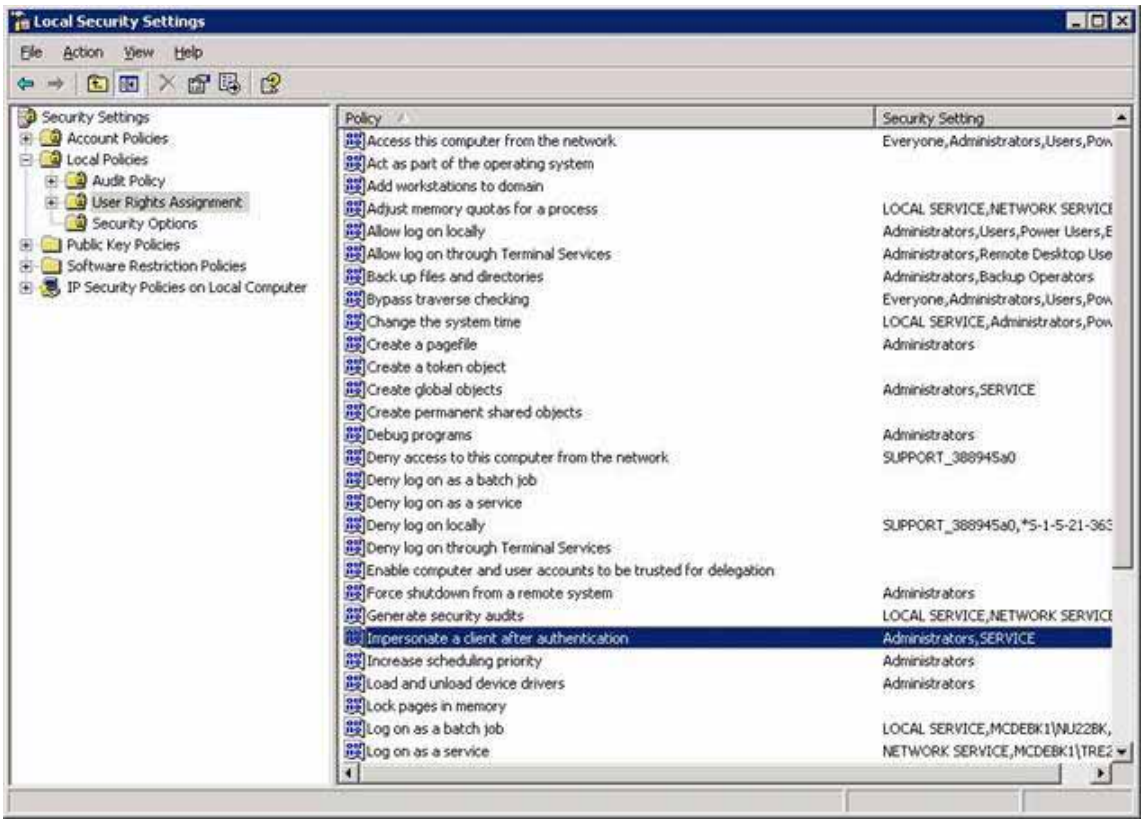
secure and proetction level	Regarding their meaning, the "**secure**" and "**protectionLevel**" attributes also comply with the Server-side attributes described and should be identical with the values set in the SOX Server.
Timeout	The „**Timeout**“ attribute determines the timeout (in ms) for a command sent by the SOX Client to the SOX Server.

tokenImpersonationLevel	Using the "**tokenImpersonationLevel**" attribute, the SOX Client can authorize the SOX Server to execute actions under the SOX Client User Account. Possible and relevant values for SOX applications are "**Identification**" and "**Impersonation**". If "**ImpersonateClients**" has been set to "**true**" in the SOX Server configuration file, the SOX Client should set the "**tokenImpersonationLevel**" attribute to "**Impersonation**". Otherwise, the SOX Server will reject certain commands leading to changes in the Database.

Impersonation

If „**ImpersonateClients**“ is set to “**true**”, the SoXServer tries to execute the command die Kommandos “Delete alarms”, Acknowledge alarms” and “Delete performance data” with the user account of the client user. But then there are some limitations.

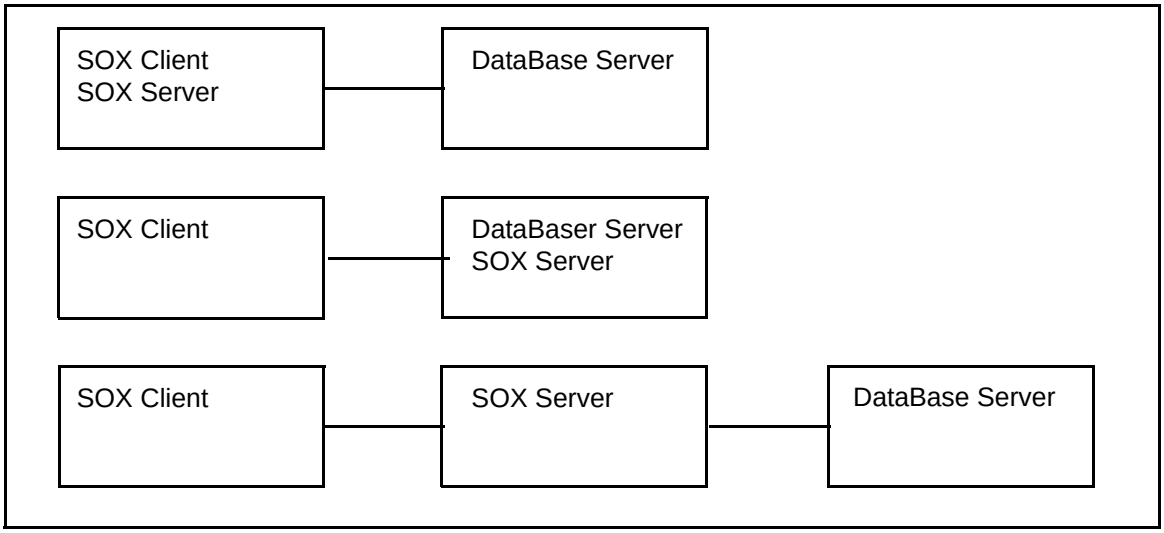
Under Windows2003 the user account of the SOX Server needs the authorization to change his Identity.



If either SOX Client and SOX Server is on the same PC or SOX Server and Database Server are on the same PC, then there are no problems with the Impersonation.

If SOX Client, SOX Server and Database Server are on different PCs, then stronger security rules become effective. All PCs must be part of an Active Directory. For authentification the Kerberos protokoll must be used. The

PCs must have the „Trust for Delegation“ authorization in the ActiveDirectory. The SOX Client must give the SOX Server the authorization to delegate his user authorization to the Database Server. To allow this the entry „**tokenImpersonationLevel**“ in the SOX Client config file must be set to „**Delegation**“. In this case it seems to be easier to resign the Impersonation and to use the Microsoft Authorization Manager (AzMan) instead to check the user authorization in the SOX Server.



6.3 Connection of the XMP1 Network to SOX

This chapter describes the connection of the XMP1 system to ServiceOn XMP1.

6.3.1 General

The XMP1 nodes and thus the XMP1 network are equipped with interfaces which permit the configuration, control and supervision of the XMP1 system via the ServiceOn XMP1 Management System.

These interfaces referred to as Access Points in the SOX can have different characteristics.

The following interfaces are made available:

- Ethernet interface (Ethernet adapter or Control Unit Expansion CU-E)
- F-interface (RS232)

These interfaces are located on the Central Unit of the XMP1 node.

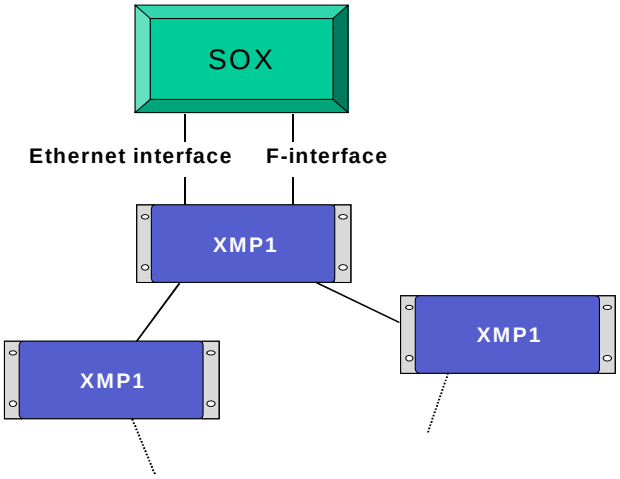


Figure 6.6: Management and control interfaces

The different SOX connection options to the XMP1 network are described in the following section.

6.3.2 SOX communication with network/nodes

Depending on the hardware of the XMP1 Access Point, communication between the SOX and network can take place in different ways.

- Directly via TCP/IP using an Ethernet adapter or CU-E on XMP1 Central Units (62.7040.xxx) or
- using the XmpIpDrv software undertaking a TCP/IP to RS232 conversion. This XmpIpDrv software is operated in addition to the SOX software on the same PC and permits direct access to the node via a serial interface (RS232 connection).
  - — However, using the same XmpIpDrv software, a remote PC can provide a RS232 connection to a node or network connected. In this case the PC requires a TCP/IP connection and is addressed via an IP address.

The different connection options are described in the following sections.

6.3.2.1 Connection of SOX via TCP/IP

The SOX can be connected directly or via an LAN to the Ethernet adapter.

The Ethernet adapter/CU-E is located on the Central Unit (> version 3.0).

Direct connection to the Ethernet adapter
In this case the PC is connected directly to X20 of the Ethernet adapter/CU-E by means of a connecting cable. X20 is a shielded 8-pin RJ45 female connector.

The Ethernet adapter/CU-E must be assigned an IP address.

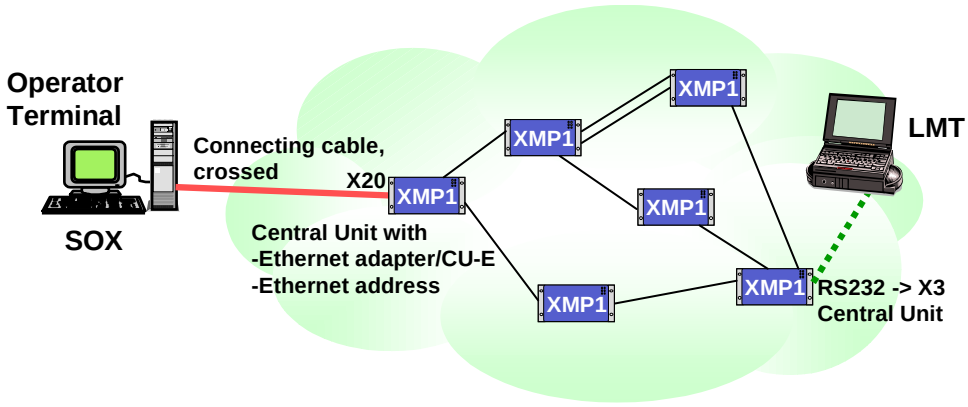
An Access Point must be configured in the SOX and assigned the following attributes:

Host name: Enter the IP address of the Ethernet adapter/CU-E.

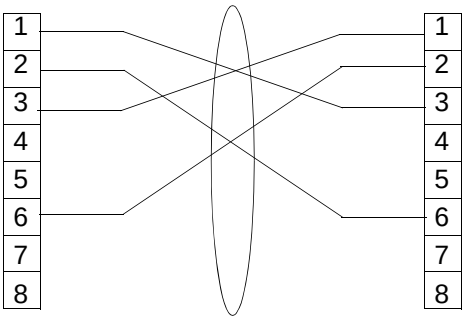
IP port number: Enter "direct IP node".

Priority: No entry, since there is only one Access Point.

The following diagram shows the direct connection of the PC to the Ethernet adapter/CU-E by means of a connecting cable.



Note: Use a crossed connecting cable to set up a direct connection between the Ethernet interface and PC. (Interconnect X4, Pin 1 -> X4, Pin 3 and X4, Pin 2 -> X4, Pin 6 by cables).



The following table shows the pin assignment of the X20 connector located on the Ethernet interface:

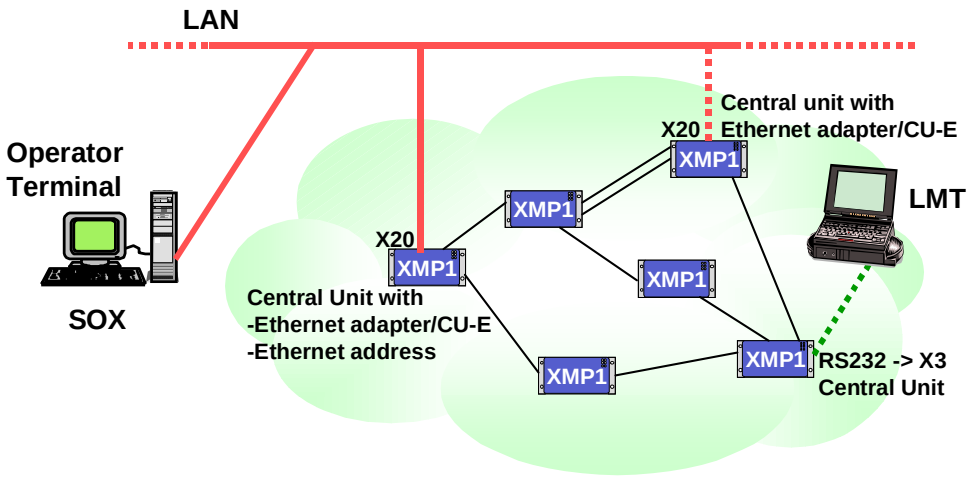
Table 6.D: Connector X20

Pin	Assignment
1	TDP (TPOP), Transmit Data
2	TDM (TPON) Transmit Data
3	RDP (TPIPI) Receive Data
4	-
5	-
6	RDM (TPIN) Receive Data
7	-
8	-

Figure 6.7: Connector assignment X20 (Ethernet interface)

Connection to the Ethernet interface via LAN

The following diagram shows how the PC can be connected via an existing LAN infrastructure.



The PC (SOX) is connected to an existing LAN.

The XMP1 node is connected also to this LAN via X20 of the Ethernet adapter/CU-E. For a redundant connection, several network Access Points can be defined. In this case, the configured Access Points must be assigned priorities. The highest priority access is used.

The Ethernet adapter/CU-E must be assigned an IP address.

In the SOX, the Access Point must be configured and assigned the following attributes:

Host name:	Enter the IP address of the Ethernet adapter/CU-E.
IP port number:	Enter "direct IP node".
Priority:	Enter the priority if several Access Points are used for one Area.

6.3.2.2 Connection via F-interface (RS232)

Direct access to the RS232 interface of a node

The following diagram shows how the PC (SOX) can be directly connected to the RS232 interface (X3) of the Central Unit by means of a connecting cable. The XMPIpDrv software required for this type of connection is available on the PC besides the SOX software.

In the SOX, an Access Point must be configured and assigned the following attributes:

Host name: Enter "local host".

IP port number: Enter the COM interface (COM1, COM2, COM...) of the PC used.

Priority: No entry required.

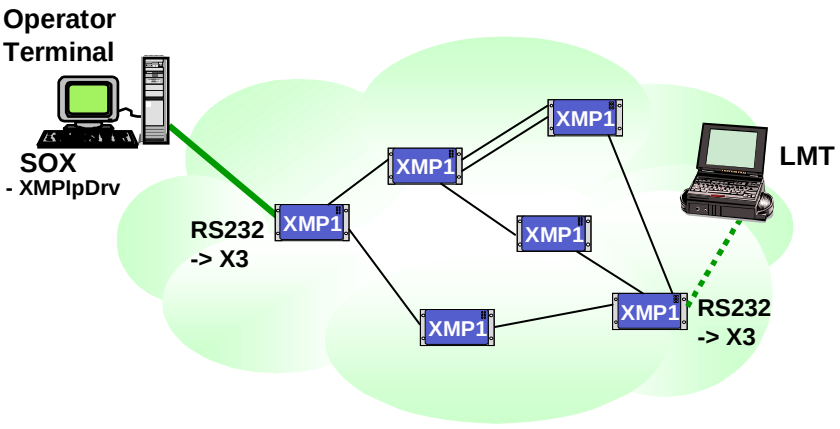
XMPIpDrv COM settings:
Adjustment of the baud rate, parity and stop bits for the COM interface.

Note: An automatic connection setup to the network (Central Unit 62.7040.xxx.xx) via the COM interface is not possible with all SOX and Central Unit settings.

Examples:

- Settings on SOX: 57600bd, odd, 1 and on Central Unit: >2400bd, odd, 1
- Settings on SOX: 19200bd, odd, 1 and on Central Unit: >2400bd, none, 1
- Settings on SOX: 19200bd, odd, 1 and on Central Unit: 1200 or 2400bd, odd, 1

An automatic baud rate identification is possible only in the range from 4800 to 38400 Bd. The parity used may be even or odd. If a different baud rate is required, the automatic identification function must be switched off first (Central Unit - ABM Switch 5 (sub-address 0)). Then the required parameters can be permanently adjusted by means of menu code 23.



Remote access via a remote PC using XMPIpDrv

In the example described below, the SOX is connected to a XMP1 node via a remote PC.

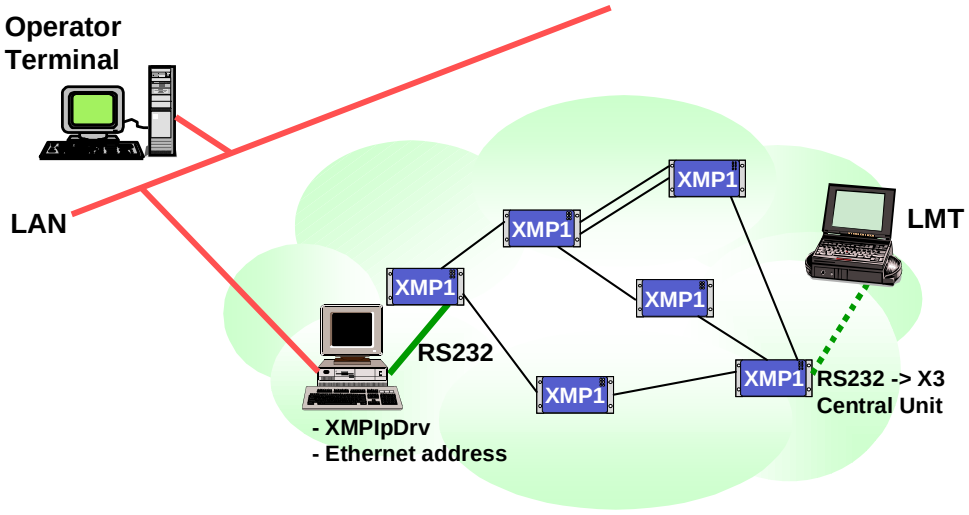
The SOX and remote PC are interconnected via a LAN.

The remote PC is connected via a COM port to the RS232 interface of the XMP1 node.

The remote PC must be loaded with the XMPIpDrv software and started up. In addition, the remote PC must be assigned an Ethernet address.

In the SOX, an Access Point must be defined. In this example, this is the remote PC. The following attributes must be assigned:

Host name:	Enter the IP address of the remote PC.
IP port number:	Enter "direct IP node".
Priority:	Enter the priority if several Access Points are used for one Area.



6.3.3 IP settings for the Ethernet adapter/CU-E

If the XMP1 network is connected via an Ethernet adapter/CU-E, IP settings are required for the latter.

The IP configuration data can be entered manually via the LSP PDA or WINLSP or via a BootP/DHCP server.

The manual settings required can be made using LSP/WINLSP menu item 7: IP Settings.

> **Note:** Settings made via menu item 7: IP Settings will not become effective until the node is reset.

> **Note:** If the DCCE between SDH nodes is used for communication, the subnet 192.168.167.0 with the subnet mask 255.255.255.0 (alternative notation: 192.168.167.0/24) should not be used, because this is used for internal purpose, if no SOA is configured.

Menu item 70: Enter IP Address

The IP address clearly identifies a network element (NE) within the network (Internet/Intranet). It can be entered either manually or via a BootP/DHCP Server.
In menu item 70, the IP address (Internet Protocol address) of the network element (Central Unit -> Ethernet IF) is entered. To permit a manual entry, the "Static value" option must be selected via menu item 74.

The setting required for Boot/DHCP server is made via menu item 74.

Menu item 71: Enter Gateway

The IP address of the Gateway is entered via menu item 71.
This address is required for sending NE messages to a computer located in another IP subnet and addressable only using IP routing. Any IP network can exist between the NE and computer.

> **Note:** Setting a gateway consistent with the network (to the own IP address and network mask) for PDH nodes with Ethernet adapter is mandatory. Otherwise the interface cannot be used.

> Setting a gateway is recommended for an access node with SDH. Normally it is available in the connected network.

> Normally a remote SDH node forms a own network with itself as a single host when operates as SDH node via DCC. In this case it is not meaningful to enter a gateway. The routes are configured with OSPF. Enter 0.0.0.0.

Menu item 72: Enter Subnet Mask

Using the subnet mask option, you can mask part of the IP address (Internet Protocol address). This leads to a splitup of the IP address into the network and host portion.
Example: 255.255.0.0

Menu item 73: Enter DNS Address

The IP address of the Domain Name Server (DNS) is entered via menu item 73. The DNS performs a translation between the host name and IP address.

Menu item 74: Enter Address Source Mode

BootP always
The NE gets the IP configuration data exclusively from a BootP/DHCP Server. If no BootP/DHCP Server is addressable, IP operation is not possible.

BootP + Fallback
The NE gets the IP configuration data from a BootP/DHCP Server. If the BootP/DHCP Server is not addressable, the data stored in the NE are used.

BootP + Fallback + Update
The NE gets the IP configuration data from a BootP/DHCP Server. If the BootP/DHCP Server is not addressable, the data stored in the NE are used. Once the BootP/DHCP Server can be addressed again, the data provided by the latter are used. The memory in the NE is overwritten by these data.

Static values
IP settings are manually entered via menu items 70-73 of LSP/WINLSP.

Menue item 79: Activate the IP settings

Via menu item 79, you can activate the IP settings.

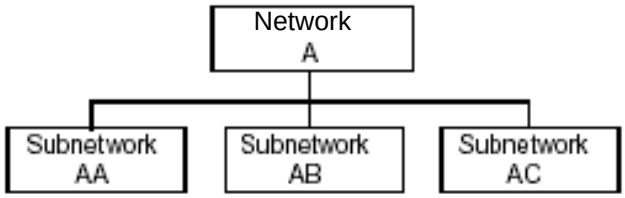
> **Note:** In case of a Central Unit equipped with a CUE sub-board, the IP settings must be taken over by means of a reset, e.g. by extracting and reinserting the Central Unit or by entering the "reset p" debugging command.

6.4 Network Views in the SOX

Using the ServiceOn XMP1 software, a network can be displayed either in the Graphical View or in a Tree View.

6.4.1 Graphical View

The Graphical View offers the possibility to set up a network topology by means of layers and configure the network in a clear form. A layer represents a certain part of the network such as an area.



In the Graphical View, background pictures such as maps can be inserted. Thus, it is possible to show the local position of both network elements and connections and provide a clear overview of the network. The icons and symbols available for setting up a XMP1 network are made available by a toolbox. In the Graphical View, the alarm status of a network element is indicated by the icons or symbols displayed in different colours. The respective colour represents a combination of all alarms that have occurred in the corresponding network element.

The following screenshots show an example of the graphical display of Network A and Sub-network AA.

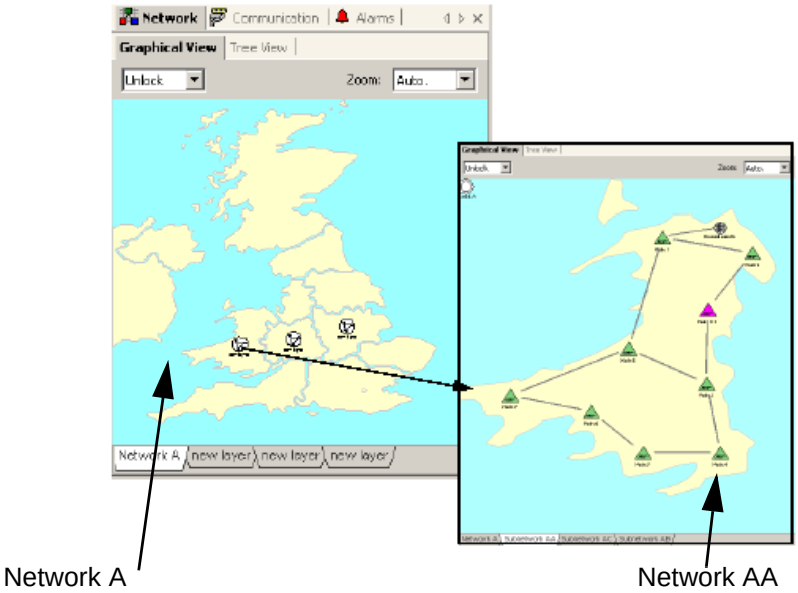


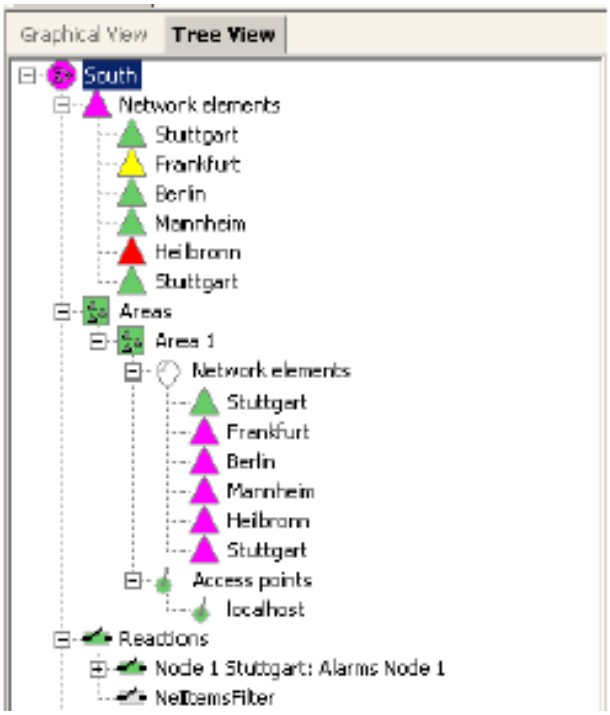
Figure 6.8: Graphical View

6.4.2 Tree View

In the Tree View, the network structure is displayed with its

- Network elements
- Areas
- Reactions

The following screenshot shows an example of a network displayed in the Tree View.



6.5 Database

The configuration data of XMP1 networks are stored in a MS SQL 2000 database.

The MS SQL server should (in the current single-user version) be installed on the same PC as the SOX software.

The MS SQL server can manage several (arbitrary) databases. The configuration data of a XMP1 network are always stored in a database. Currently, only one network is supported by each database. However, since the MS SQL server can manage several databases, several XMP1 networks or several XMP1 network statuses can be stored.

When starting the SOX-NMS application, the database - and thus the network - must be selected via the "Select Database" option.

The name of the database, which shall be used to store the configuration data of a XMP1 network, can be freely selected. However, it is recommended to clearly specify both the database and network. Furthermore an additional version identifier, e.g. SOX version or date, is recommended, since with a new SOX version a new database is created.

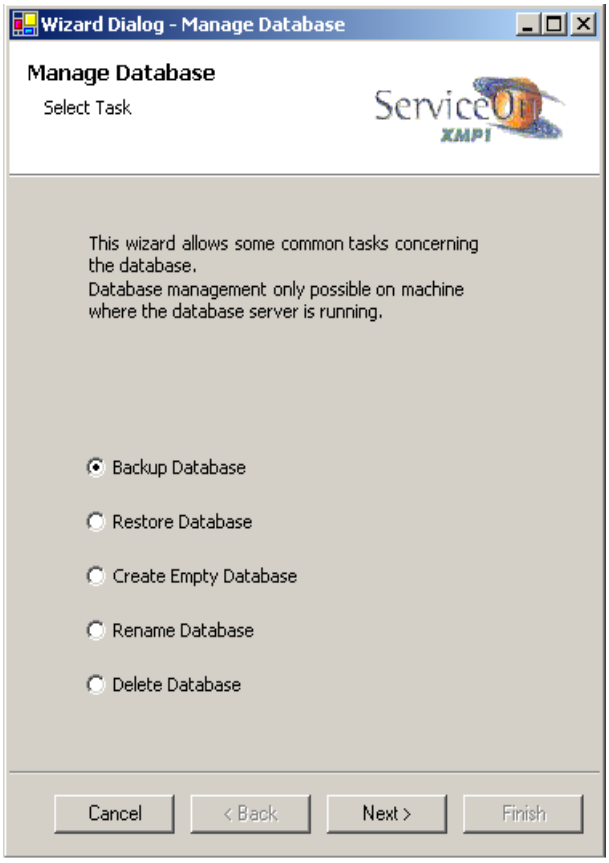
Example: Railtrack 4.0.3 or Railtrack Jan04 or Railtrack A

Database Management

Using the "Database -> Manage Database" SOX function, the database can be managed. However, please note that the database used in the current session is manageable only to a limited extent.

The following options are offered under the "Databases -> Manage Database" function:

- Backup Database
- Restore Database
- Create Empty Database
- Rename Database
- Delete Database


Wizard Dialog - Manage Database
Manage Database
Select Task
ServiceOn
XMPI
This wizard allows some common tasks concerning the database.
Database management only possible on machine where the database server is running.
Backup Database
Restore Database
Create Empty Database
Rename Database
Delete Database
Cancel
< Back
Next >
Finish

6.6 Online Functions

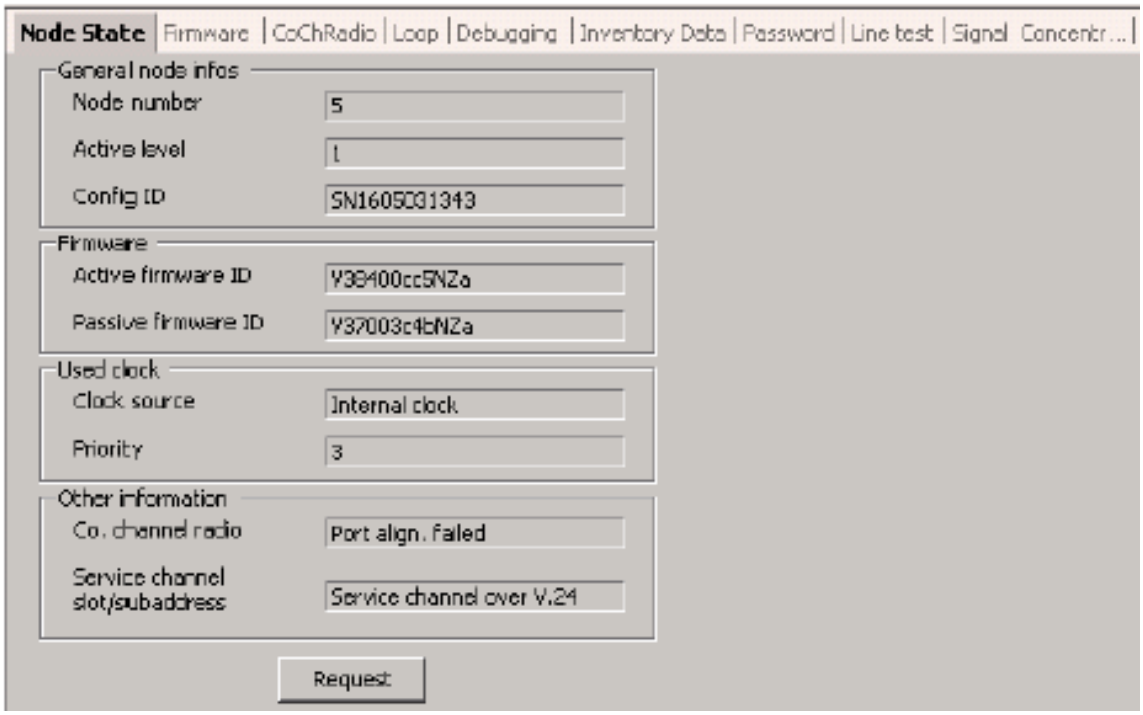
The SOX online functions enable the user to request information from or undertake certain actions in the network.

The following online functions are available:

- Node state
- Firmware
- CoChannel Radio
- Loop
- Debugging
- Inventory Data
- Password
- Signal concentrator
- Line test

These online functions are briefly described in the following section.

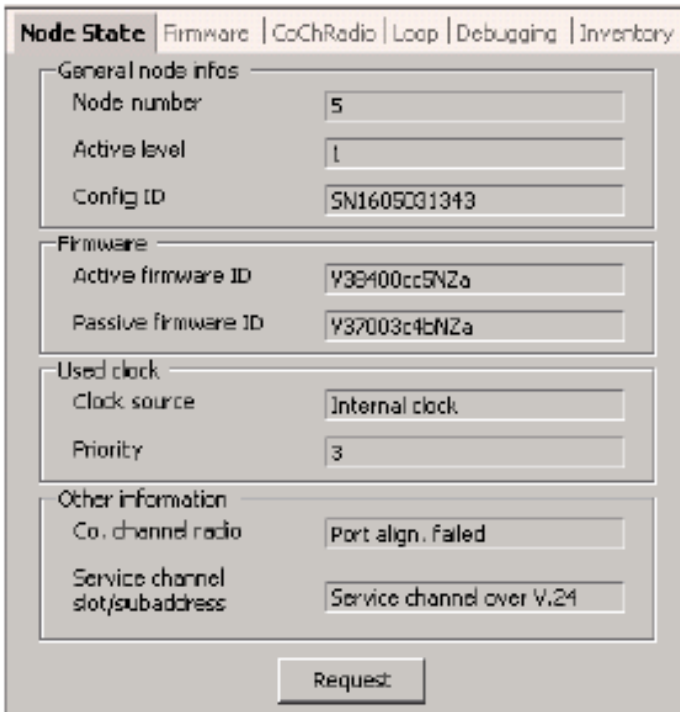
The following screenshot shows the SOX mask offering online functions:



6.6.1 Node State

The following node information can be requested:

- General Node Info
  - Node number
  - Active level
  - Config Id
- Firmware
  - Active firmware ID
  - Passive firmware ID
- Used Clock
  - Clock source
  - Priority
- Other Information
  - Co-channel radio
  - Service channel/Slot/Subaddress

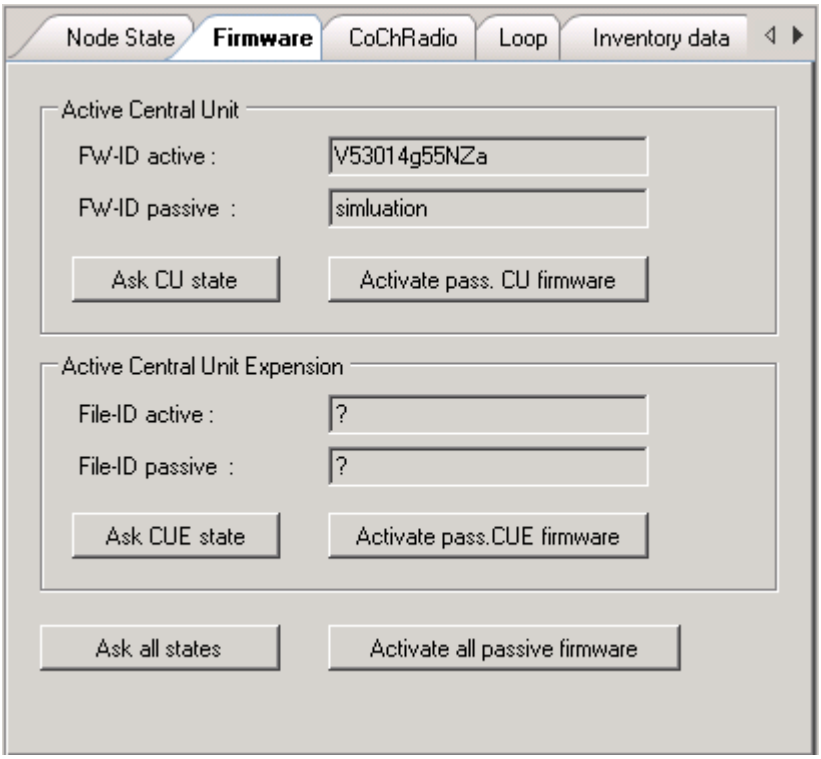


6.6.2 Firmware

The "Firmware" mask displays information regarding the firmware loaded in the node. Here a distinction is made between the "active" and "passive" firmware. The firmware is identified by its firmware ID.

Example: **V37003c4bNZa**

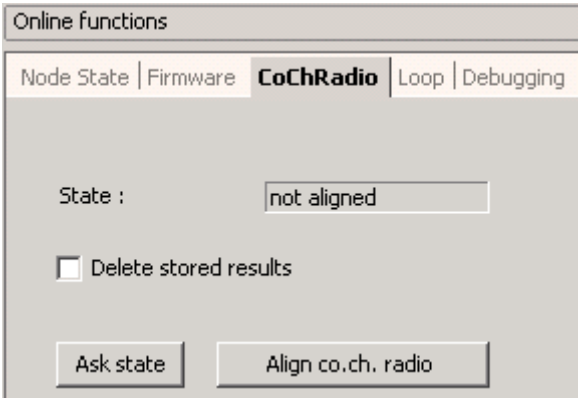
In this mask, you can switch over between the "active" and "passive" firmware.



6.6.3 CoChannel Radio

If the ports of a node are used to transmit co-channel radio data, the ports must be aligned. This alignment is performed using the "Co-Channel Radio" mask.

Only fully operational nodes can be aligned. Whenever a node displays a fault, first eliminate the cause before you start up the alignment process.

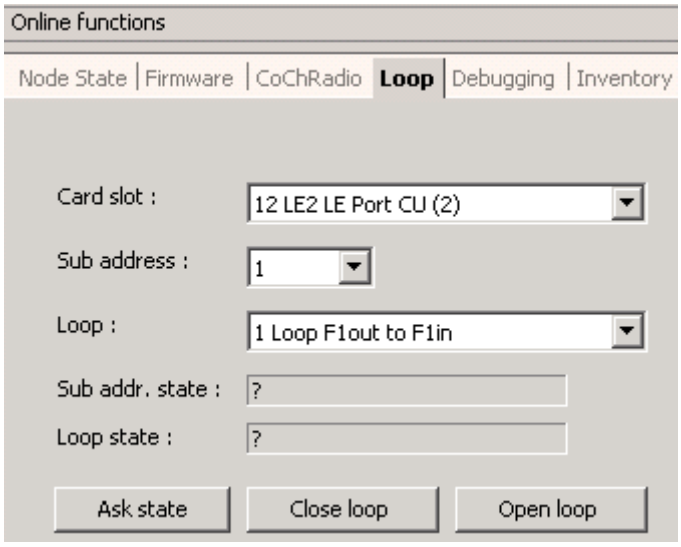

Online functions
Node State
Firmware
CoChRadio
Loop
Debugging
State :
not aligned
Delete stored results
Ask state
Align co.ch. radio

6.6.4 Loop

On certain modules of the system, loops can be switched for testing purposes.

This is possible via the "Loop" mask that can be called up in the "Online Functions" window.

In case of modules composed of several boards, possible loops are displayed individually for each board provided that the expanded configuration option has been selected and the boards have been defined.



Possible loops

Table 6.D: Test loops KZU, KZU II, DSK, DSK modular

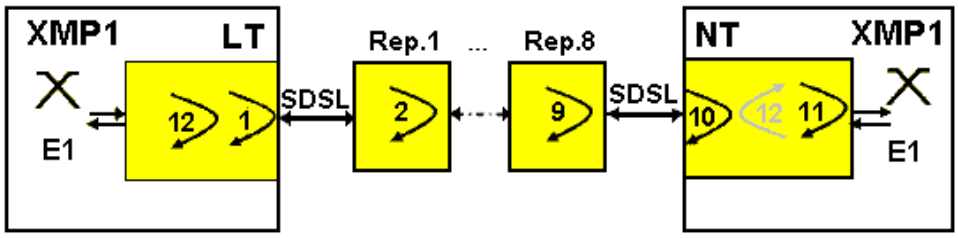
Loop no.	KZU				KZU II			DSK					DSK modular	
	FEK	SUB	EX	OSX	FEK	SUB	EX	64k	V24	X21	WT	V35	MDV	MDG
1	A	A	A	A	A	A	A	Internal loop (F1)	Loop 3c ITU V.54	Loop 3c ITU V.54	Loop 3c ITU V.54	Loop 3c ITU V.54	Loop 3 ITU V.54	Loop (D2)
2	D	D	D	D	D	D	D		Loop 2b ITU V.54	Loop 2b ITU V.54	Loop 2b ITU V.54	Loop 2b ITU V.54	Loop 2 ITU V.54	Remote loop
3												Switch-ing matrix loop; control line	Loop 3 and Loop 2	Near-end and remote loop
4														

Table 6.E: Loops

Loop no.	ISDN				Port				
	UQF (4)	Uk0/Uk0F	S0F (4)	S0 / S0F	HDB3 LE	LE34 OPT	MUX34	LEU	LOU opt u.
1	B1&B2 without B* on both sides	B1&B2 without B* on both sides	B1&B2 without B* on both sides	B1&B2 without B* on both sides	Loop F1out -> F1in	F2 loop (coaxial)	Local loop (F1)	Loop F1out -> F1in	Loop F1out -> F1in
2	UK0 Loop	UK0 Loop	B1, B2 & B* on one side	B1, B2 & B* on one side		F1 loop (optical)			
3	B1, B2 & B* on both sides	B1, B2 & B* on both sides	B1, B2 & B* on both sides	B1, B2 & B* on both sides					
4	External remote loop	External remote loop	External remote loop	External remote loop					

Table 6.F: Test loops SHDSL

Loop no.	SHDSL
1	LT SDSL loop NS direction
10	NT SDSL loop NS direction
11	NT E1 loop
12	Local E1 loop



6.6.5 Debugging

Using the debugging function, debug commands can be sent to the node. These commands can be used to make requests or settings in the node. There are debugging commands answered by the node with a return message and other ones without a return message from the node.

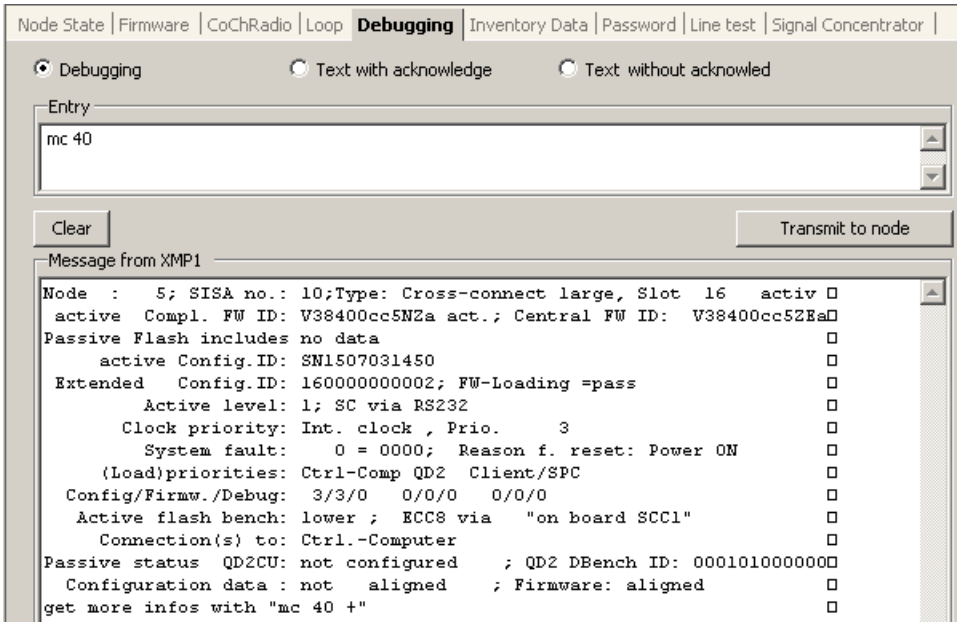
Mailing

The user can send texts to the nodes and define passwords using the following functions:

— Send text to node display with and without acknowledgement.

Debugging, Soft-ABM

In addition, it is possible to send commands to the node with the answer from the node being displayed. Besides pure debugging commands, these also include Soft-ABM commands which are used to make special settings in the node or request certain information from it.


Node State
Firmware
CoChRadio
Loop
Debugging
Inventory Data
Password
Line test
Signal Concentrator
Debugging
Text with acknowledge
Text without acknowled
Entry
mc 40
Clear
Transmit to node
Message from XMP1
Node : 5; SISA no.: 10;Type: Cross-connect large, Slot 16 activ
active Compl. FW ID: V38400cc5NZa act.; Central FW ID: V38400cc5ZEa
Passive Flash includes no data
active Config.ID: SN1507031450
Extended Config.ID: 160000000002; FW-Loading =pass
Active level: 1; SC via RS232
Clock priority: Int. clock , Prio. 3
System fault: 0 = 0000; Reason f. reset: Power ON
(Load)priorities: Ctrl-Comp QD2 Client/SPC
Config/Firmw./Debug: 3/3/0 0/0/0 0/0/0
Active flash bench: lower ; ECC8 via "on board SCC1"
Connection(s) to: Ctrl.-Computer
Passive status QD2CU: not configured ; QD2 DBench ID: 000101000000
Configuration data : not aligned ; Firmware: aligned
get more infos with "mc 40 +"

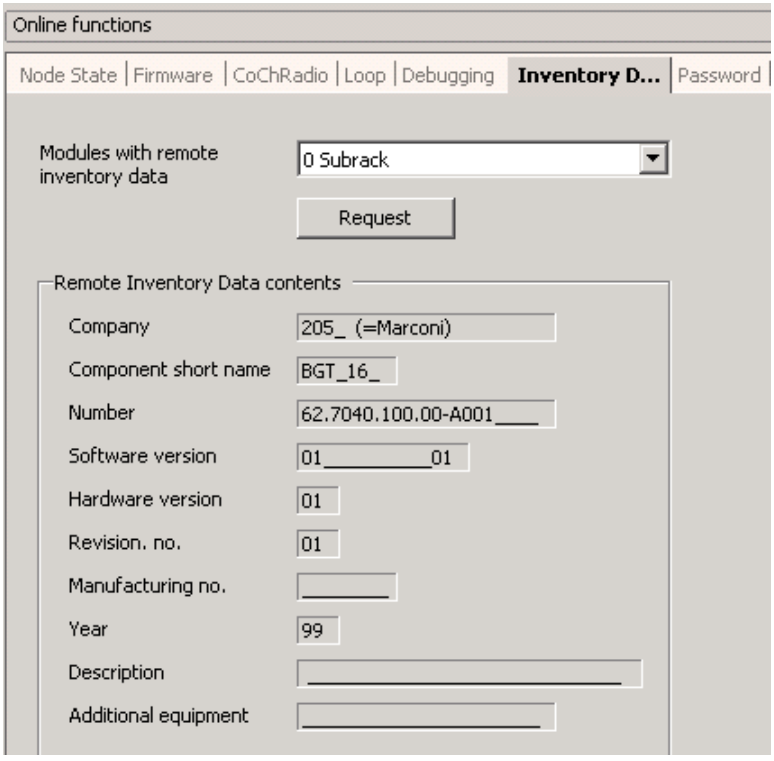
6.6.6 Inventory Data

The XMP1 modules and boards are equipped with an electronic nameplate (GBÜ-EPROM) which contains the RID data (remote inventory data).

These can include all or part of the following data:

- Company ID
- Equipment short designation
- Part no.
- Software release
- Equipment level
- Revision level
- Manufacturing no. and data
- Equipment designation
- Retrofitting information

This function permits the RID data to be read out and displayed.



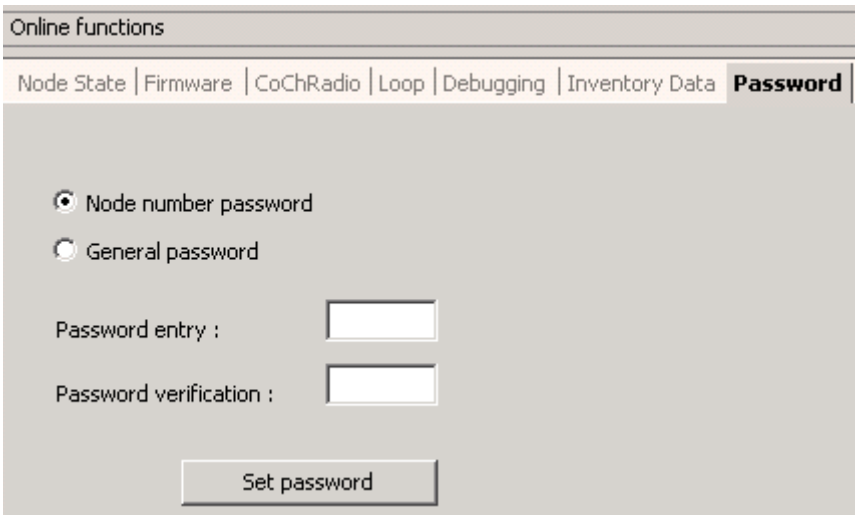
6.6.7 Password

To prevent unauthorized access to certain functions, it is possible to define passwords. A distinction is made between two different types of passwords:

- Node number password
- General password

The "Node number password" is required by the user to modify the number of the node.

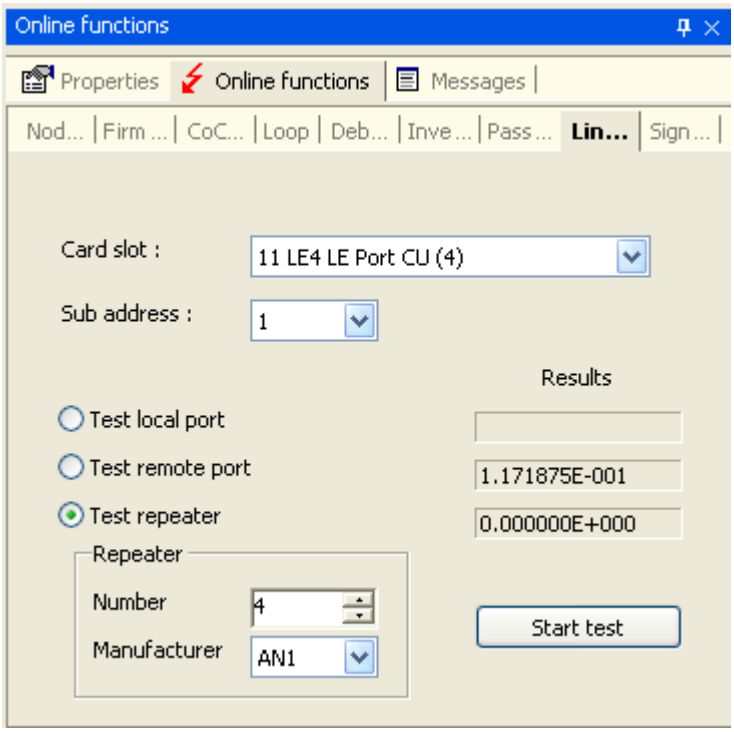
The "General password" is required by the user to execute the functions made available via the menus System Test, Fault Location, Service Units etc.



6.6.8 Line Test

Using the line test function it is possible to check and evaluate any port-to-port connection defined between two nodes. The transmission link between these nodes can include repeaters. Each repeater available on the link is unambiguously assigned to a node.

The line test is used to detect a defective port, a fault that has occurred on the transmission link between two ports or a fault between a port and repeater. A fault between a port and repeater can have its cause either in the repeater or on the link. The link test permits a connection error to be localized.



6.6.9 Signal Concentrator

The signal concentrator provides the interfaces (sensors and transmitters) to external devices.

Using the sensors, messages from external units can be processed. Control functions from external devices are possible via the transmitters.

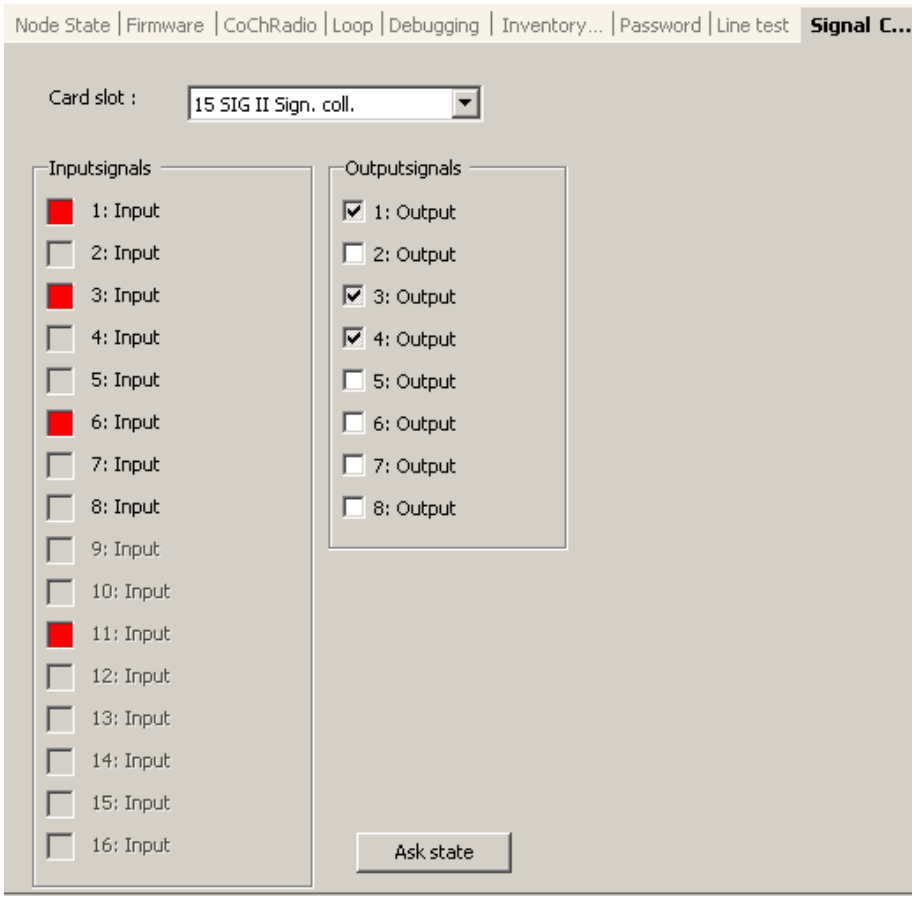
Possible message sources:

- Alarm messages from external unit with 7R signalling
- A / B / EL alarms
- ZA(A)/ZA(B) contacts
- Door contacts
- Fire detector

Possible controls via the sensors:

- Central alarm signalling

The following screenshot shows the "Signal Concentrator" mask in the "Online Functions" window.



6.7 Network Reactions

Using the "Network Reactions" option, you can configure a certain reaction to be triggered in a **target** in consequence of one or several alarms generated by a certain **source**.

Alarms are considered as the **source** of a network reaction (Reaction).

> **Note:** The signal available at a signal concentrator input is also treated as an alarm.

The network reaction configured as **target** can be a

- Mail Reaction (e-mail transmission)
- Sound Reaction (generation of a signal tone)
- Switch Reaction (switching a transmitter)
- Alarm Printer
- Northbound Interface

As to which alarms trigger a reaction can be adjusted by means of a filter or observer.

The configuration of network reactions is performed in the "Tree view" under "Reactions". For this purpose, the "Filter", "Observer" and "Reactions" options are available.

Filter

Using the filter, you can define an address whose alarms shall trigger a certain reaction. To do this, the "Address Filter" and "Alarm Type Filter" boxes must be configured correspondingly.

The "Address Filter" option permits the selection of a complete network, node, card slot or sub-address. Other elements cannot be used.

Using the "Alarm Type Filter", you can define as to which alarms shall be taken into consideration.

Observer

Using an observer, you can define a reaction to be triggered for a certain address on occurrence of an alarm with a certain severity. The address entered can be a network, node or a sub-address.

For switching signal concentrator outputs, the observer is used in conjunction with a switch reaction.

The following severities are possible:

- OK
- Minor
- Critical

Reactions

Network reactions are configured in the "Tree View" of the SOX Network Manager via the "Reactions" option. Normally, network reactions are configured in the structure hierarchically below a filter or observer. If a network reaction is defined in the structure directly below "Reactions", the alarms will not be filtered.

The following network reactions can be configured:

- Mail Reaction
- Sound Reaction
- Sound Reaction
- Alarm Printer
- Northbound Interface

Mail Reaction
An alarm is followed by an e-mail transmitted to a defined address.

Sound Reaction
With this option selected, an alarm is followed by an alarm signal generated by the computer. Please ensure that the loudspeaker is active.

Switch Reaction
Using the "Switch Reaction" option, outputs can be applied to a certain signal concentrator.

Alarm Printer
Using the "Alarm Printer" option, filtered alarms can be printed out.

Northbound Interface
The "Northbound Interface" options offers the possibility to transmit the filtered alarms to a higher-order monitoring system.

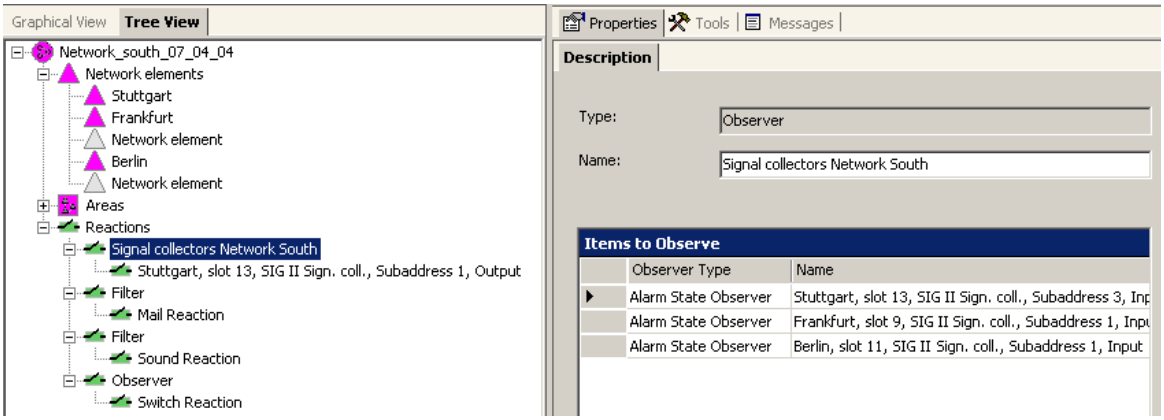


Fig. 6.9 shows a possible configuration of a network reaction with a signal concentrator.

Node 1:
The alarms of door contacts 1 to 3 in node 1 shall be applied to sensors 1 to 3 of the signal concentrator mounted in card slot 7.

Node 2:
The alarms of sensors 1, 2 and 3 of node 1 as well as the alarms of card slot 9, sub-address 1, ISDN S0F shall be made available as general alarm in node 2 via the signal concentrator mounted in card slot 12, transmitter 1.

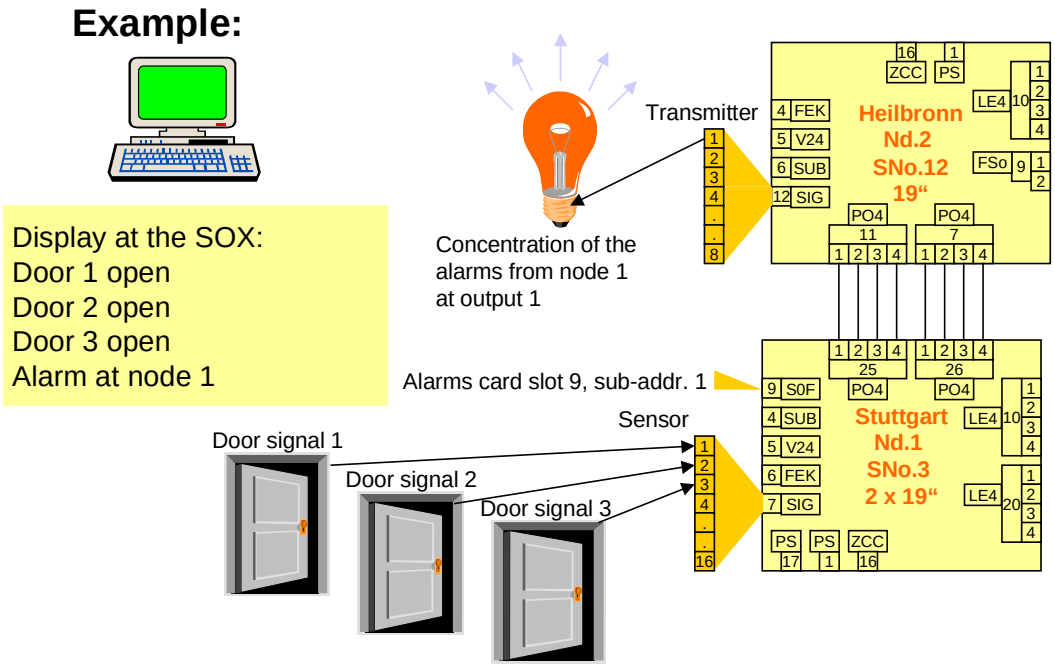


Figure 6.9: Network reaction, example

6.8 Alarm Management

The Alarm Management fulfills the following functions:

- Network-wide alarm management
- Display of spontaneous alarms in the network
- Display of alarm statuses of sub-networks or layers
- Alarm status request when the node goes online
- Recording of alarms, signal concentrator statuses, special system statuses and user activities
- Network reactions:
  Control of signal concentrator outputs due to signal concentrator inputs or alarms
- Network-wide request of all alarms (request current network status)

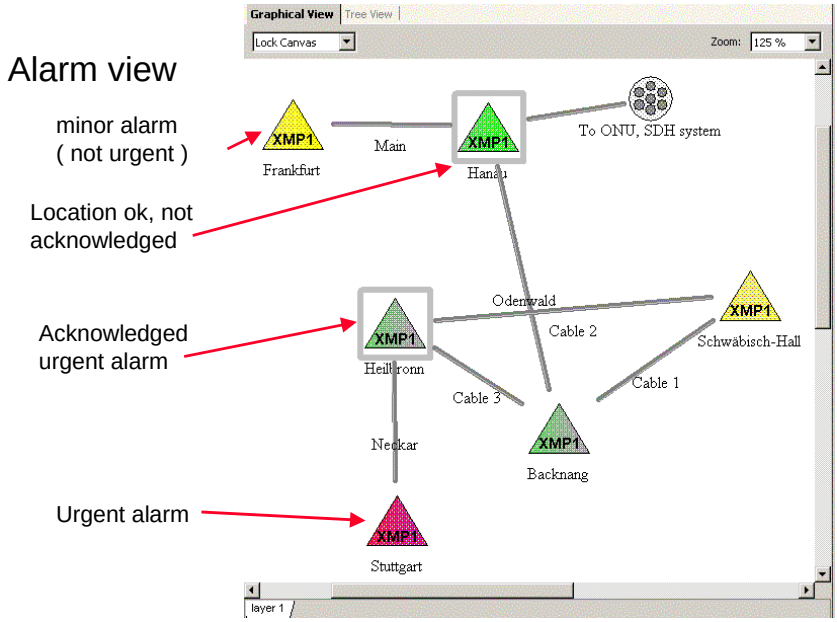
The alarms of the XMP1 network are displayed both in the Graphical View and in the alarm list.

The alarms of all network elements (nodes) available in a network are included in the alarm list of the SOX Network Manager. All network element alarms, module alarms, sub-address alarms and interface alarms are displayed.

The alarm list of the LCT SOX includes all alarms of the current network element, all cards, sub-addresses and interfaces. In addition, the signal inputs of the signal concentrators available are displayed.

Alarm display in the Graphical View

In the Graphical View, the alarm status of a network element is indicated by the icons or symbols displayed in different colours. The respective colour represents a combination of all alarms that have occurred in the corresponding network element.



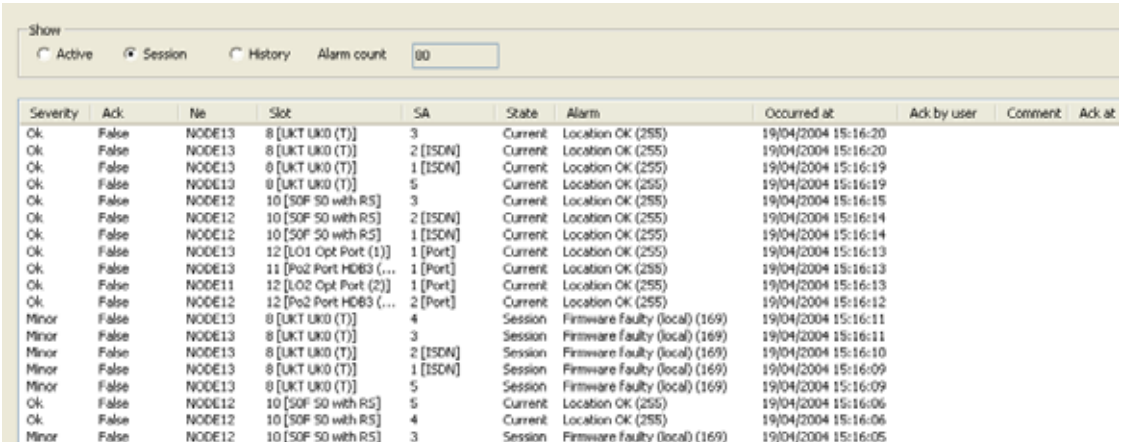
Alarm list

In the alarm list, alarms are displayed in table form.

It is possible to display the alarms of the current session, active alarms or an alarm history.

In the alarm list, alarms can be deleted and acknowledged.

The following diagram shows the ServiceOn XMP1 alarm list.


Show
Active
Session
History
Alarm count
00
Severity Ack Ne Slot SA State Alarm Occurred at Ack by user Comment Ack at
Ok False NODE13 8 [UKT UK0 (T)] 3 Current Location OK (255) 19/04/2004 15:16:20
Ok False NODE13 8 [UKT UK0 (T)] 2 [ISDN] Current Location OK (255) 19/04/2004 15:16:20
Ok False NODE13 8 [UKT UK0 (T)] 1 [ISDN] Current Location OK (255) 19/04/2004 15:16:19
Ok False NODE13 8 [UKT UK0 (T)] 5 Current Location OK (255) 19/04/2004 15:16:19
Ok False NODE12 10 [S0F S0 with RS] 3 Current Location OK (255) 19/04/2004 15:16:15
Ok False NODE12 10 [S0F S0 with RS] 2 [ISDN] Current Location OK (255) 19/04/2004 15:16:14
Ok False NODE12 10 [S0F S0 with RS] 1 [ISDN] Current Location OK (255) 19/04/2004 15:16:14
Ok False NODE13 12 [LO1 Opt Port (1)] 1 [Port] Current Location OK (255) 19/04/2004 15:16:13
Ok False NODE13 11 [Po2 Port HDB3 (... 1 [Port] Current Location OK (255) 19/04/2004 15:16:13
Ok False NODE11 12 [LO2 Opt Port (2)] 1 [Port] Current Location OK (255) 19/04/2004 15:16:13
Ok False NODE12 12 [Po2 Port HDB3 (... 2 [Port] Current Location OK (255) 19/04/2004 15:16:12
Minor False NODE13 8 [UKT UK0 (T)] 4 Session Firmware faulty (local) (169) 19/04/2004 15:16:11
Minor False NODE13 8 [UKT UK0 (T)] 3 Session Firmware faulty (local) (169) 19/04/2004 15:16:11
Minor False NODE13 8 [UKT UK0 (T)] 2 [ISDN] Session Firmware faulty (local) (169) 19/04/2004 15:16:10
Minor False NODE13 8 [UKT UK0 (T)] 1 [ISDN] Session Firmware faulty (local) (169) 19/04/2004 15:16:09
Minor False NODE13 8 [UKT UK0 (T)] 5 Session Firmware faulty (local) (169) 19/04/2004 15:16:09
Ok False NODE12 10 [S0F S0 with RS] 5 Current Location OK (255) 19/04/2004 15:16:06
Ok False NODE12 10 [S0F S0 with RS] 4 Current Location OK (255) 19/04/2004 15:16:06
Minor False NODE12 10 [S0F S0 with RS] 3 Session Firmware faulty (local) (169) 19/04/2004 15:16:05

For documentation purposes, the alarm list can be exported to an xml file. The following screenshot shows an extract from such an xml file.

```
<?xml version="1.0" standalone="yes" ?>
- <alarms>
  - <alarm>
      <AlarmId>1711</AlarmId>
      <Severity>Minor</Severity>
      <NE>Stuttgart</NE>
      <Slot>16 [ZTQ QD2ZT complete]</Slot>
      <SA>1 [T3in]</SA>
      <State>Current</State>
      <Alarm>ports without co-ch.radio alig (27)</Alarm>
      <Occurred_At>21.04.2004 09:13:15</Occurred_At>
      <Ack>ports without co-ch.radio alig (27)</Ack>
      <Ack_by_User />
      <Comment />
      <Ack_At />
    </alarm>
  - <alarm>
      <AlarmId>1710</AlarmId>
      <Severity>Critical</Severity>
      <NE>Stuttgart</NE>
      <Slot>15 [SIG II Sign. coll.]</Slot>
      <SA>1 [Input]</SA>
      <State>Current</State>
      <Alarm>Wrong converter type (150)</Alarm>
      <Occurred_At>21.04.2004 09:13:15</Occurred_At>
      <Ack>Wrong converter type (150)</Ack>
      <Ack_by_User />
      <Comment />
      <Ack_At />
    </alarm>
```

6.8.1 Alarm list

Central faults

Central faults are hardware faults which do no longer permit a dialog via the 2 Mbit/s interface. In this case, AIS must be sent to F1out provided that this is still possible. Analog connections are released and blocked.

Central faults include:

- failure of the central controller
- failure of bus lines
- failure of a non-redundant system power supply.

Central alarms

Central alarms are those caused by a signal failure at F1in or by a failure of central modules and circuits still permitting data transmission via the F1out interface.

Central alarms include:

Faults in the configuration memory

- external clock failure
- synchronization clock failure at T3in
- failure of a doubled power supply

Note: The alarm contact ZA(A) is not available on each Central Unit type.

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
1	Disabl	0k		Alarm output switched off	
Central alarms:					
010	TERMIN	Critical	A and ZA (A)	System bus failure	
011	FW !	Critical	A and ZA (A)	Central firmware faulty	
012	CONFIG	Critical	A and ZA (A)	Fault in configuration data	
013	SYSF !	Critical	A and ZA (A)	Serious program fault	
014	ConfMd	Minor	A and ZA (A)	Modification - emergency configuration	
019	IncptC	Critical		CUE software incompatible	

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
020	n.T3 a	Critical	A and ZA (A)	Loss of ext. clock T3in (act.)	
021	RxCRec	Minor	A and ZA (A)	Loss of Rx clock recovery	
022	n.T3 i	Minor	B and ZA (B)	Loss of ext. clock T3in (pass.)	
023	PO NUM	Minor	A and ZA (A)	Too many ports in basic network	
024	CU TYP	Minor	A and ZA (A)	Wrong Central Unit type	
025	C_SLOT	Critical	A and ZA (A)	Equipping fault	
026	RAM	Critical	A and ZA (A)	Fault in dynamic RAM	
027	CO_CH	Minor	B and ZA (B)	Ports w/o co-ch. radio alignment	
028	ExtInp	Minor		Alarm - External input	
For PS:					
040	EQPT	Critical	A and ZA (A)	Serious equipping fault	
041	MON 7V	Critical	A and ZA (A)	+7 V voltage monitoring	
042	MON-8V	Critical	A and ZA (A)	-8 V voltage monitoring	
043	FAIL	Minor	A and ZA (A)	Standby power supply defective	
044	PS TYP	Minor	B and ZA (B)	Wrong power supply type	
045	FAIL	Minor	A and ZA (A)	Remote power supply alarm	
046	ST.Loc	Minor	EL	Static fault location active	
For Ports:					
051	nc:LFS	Critical	A and ZA (A)	HDSL: loss of HDSL frame/signal	X
052	nc: FH3	Critical	A and ZA (A)	HDSL: BER 10-3 local	X
053	fc: LFS	Critical	A and ZA (A)	HDSL: Loss E1 frame/sig remote	X
054	ng: LFS	Critical	A and ZA (A)	HDSL: Loss E1 frame/sig local	X
055	fg: LFS	Critical	A and ZA (A)	HDSL: Loss of frame or signal	X
056	fg: FH3	Critical	A and ZA (A)	HDSL: BER 10-3 remote	X
057	fc: AIS	Critical	A and ZA (A)	HDSL: AIS alarm remote	X
058	ng: AIS	Critical	A and ZA (A)	HDSL: AIS alarm local	X
059	INT	Critical	A and ZA (A)	Internal module fault	X

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
060	EQPT	Critical	A and ZA (A)	Equipping fault	X
061	LOS	Critical	A and ZA (A)	LOS at F1in	X
062	AIS	Critical	ZA(A)	AIS at F1in	X
063	F-Loc	Critical	EL	Dynamic fault location active	X
064	FLext.	Critical	EL	Fault-loc. address LE identified	X
065	BER_3	Critical	A and ZA (A)	BER 10^{-3}	X
066	CRC	Critical	A and ZA (A)	Loss of CRC4 multiframe	X
067	LOF	Critical	A and ZA (A)	Loss of sync	X
068	LOOP	Critical	EL	Loop on equipment side (F1)	X
069	EXD&SK	Critical	A and ZA (A)	Loss of multiframe and EXT D	X
070	SYN_MF	Critical	A and ZA (A)	Loss of multiframe	
071	EXTD	Minor	A and ZA (A)	Urgent alarm EXT D	X
072	EXT_DK	Minor	A and ZA (A)	Urgent alarm EXT DK	
073	Port f	Minor	EL, B and ZA (B)	Wrong port type	
079	fgPdef	Minor		HDSL: Partly defective	
080	ncPdef	Minor		HDSL: Partly defective	
081	Laser	Minor	B and ZA (B)	Laser current too high	
082	BER_4N	Minor	B and ZA (B)	BER 10^{-4} and EXT N	
083	BER_4	Minor	B and ZA (B)	BER 10^{-4}	
084	BER_5N	Minor	B and ZA (B)	BER 10^{-5} + EXT N	
085	BER_5	Minor	B and ZA (B)	BER 10^{-5}	
086	BER_6N	Minor	B and ZA (B)	BER 10^{-6} + EXT N	
087	BER_6	Minor	B and ZA (B)	BER 10^{-6}	
088	EXT_N	Minor	-	Non-urgent alarm EXT N	
089	SLIP	Minor	-	Frame slip at F1in	
090	CRCBLK	Minor	-	CRC4 block error	
091	BER_7	Minor	-	BER 10^{-7}	
092	fg:S/N	Minor	B and ZA (B)	HDSL: Signal to noise ratio	
093	fg:ER6	Minor	B and ZA (B)	HDSL: BER 10-6 remote	

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
095	nc:S/N	Minor	B and ZA (B)	HDSL: Signal to noise ratio	
096	nc:ER6	Minor	B and ZA (B)	HDSL: BER 10-6 local	
xDSL					
105	R8LosF	Critical	A and ZA (A)	xDSL: Rep#8 LOS/LOF Slave	X
106	R7LosF	Critical	A and ZA (A)	xDSL: Rep#7 LOS/LOF Slave	X
107	R6LosF	Critical	A and ZA (A)	xDSL: Rep#6 LOS/LOF Slave	X
108	R5LosF	Critical	A and ZA (A)	xDSL: Rep#5 LOS/LOF Slave	X
109	R4LosF	Critical	A and ZA (A)	xDSL: Rep#4 LOS/LOF Slave	X
110	R3LosF	Critical	A and ZA (A)	xDSL: Rep#3 LOS/LOF Slave	X
111	R2LosF	Critical	A and ZA (A)	xDSL: Rep#2 LOS/LOF Slave	X
112	R1LosF	Critical	A and ZA (A)	xDSL: Rep#1 LOS/LOF Slave	X
113	R8S NM	Minor	B and ZA (B)	xDSL: Rep#8 Noise Margin Slave	
114	R7S NM	Minor	B and ZA (B)	xDSL: Rep#7 Noise Margin Slave	
115	R6S NM	Minor	B and ZA (B)	xDSL: Rep#6 Noise Margin Slave	
116	R5S NM	Minor	B and ZA (B)	xDSL: Rep#5 Noise Margin Slave	
117	R4S NM	Minor	B and ZA (B)	xDSL: Rep#4 Noise Margin Slave	
118	R3S NM	Minor	B and ZA (B)	xDSL: Rep#3 Noise Margin Slave	
119	R2S NM	Minor	B and ZA (B)	xDSL: Rep#2 Noise Margin Slave	
120	R1S NM	Minor	B and ZA (B)	xDSL: Rep#1 Noise Margin Slave	
121	R8M NM	Minor	B and ZA (B)	xDSL: Rep#8 Noise Margin Master	
122	R7M NM	Minor	B and ZA (B)	xDSL: Rep#7 Noise Margin Master	

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
123	R6M NM	Minor	B and ZA (B)	xDSL: Rep#6 Noise Margin Master	
124	R5M NM	Minor	B and ZA (B)	xDSL: Rep#5 Noise Margin Master	
125	R4M NM	Minor	B and ZA (B)	xDSL: Rep#4 Noise Margin Master	
126	R3M NM	Minor	B and ZA (B)	xDSL: Rep#3 Noise Margin Master	
127	R2M NM	Minor	B and ZA (B)	xDSL: Rep#2 Noise Margin Master	
128	R1M NM	Minor	B and ZA (B)	xDSL: Rep#1 Noise Margin Master	
129	R8SEr6	Minor	B and ZA (B)	xDSL: Rep#8 BER 10E-6 Slave	
130	R7SEr6	Minor	B and ZA (B)	xDSL: Rep#7 BER 10E-6 Slave	
131	R6SEr6	Minor	B and ZA (B)	xDSL: Rep#6 BER 10E-6 Slave	
132	R5SEr6	Minor	B and ZA (B)	xDSL: Rep#5 BER 10E-6 Slave	
133	R4SEr6	Minor	B and ZA (B)	xDSL: Rep#4 BER 10E-6 Slave	
134	R3SEr6	Minor	B and ZA (B)	xDSL: Rep#3 BER 10E-6 Slave	
135	R2SEr6	Minor	B and ZA (B)	xDSL: Rep#2 BER 10E-6 Slave	
136	R1SEr6	Minor	B and ZA (B)	xDSL: Rep#1 BER 10E-6 Slave	
137	R8MEr6	Minor	B and ZA (B)	xDSL: Rep#8 BER 10E-6 Master	
138	R7MEr6	Minor	B and ZA (B)	xDSL: Rep#7 BER 10E-6 Master	
139	R6MEr6	Minor	B and ZA (B)	xDSL: Rep#6 BER 10E-6 Master	
140	R5MEr6	Minor	B and ZA (B)	xDSL: Rep#5 BER 10E-6 Master	
141	R4MEr6	Minor	B and ZA (B)	xDSL: Rep#4 BER 10E-6 Master	
142	R3MEr6	Minor	B and ZA (B)	xDSL: Rep#3 BER 10E-6 Master	

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
143	R2MEr6	Minor	B and ZA (B)	xDSL: Rep#2 BER 10E-6 Master	
144	R1MEr6	Minor	B and ZA (B)	xDSL: Rep#1 BER 10E-6 Master	
For KZUs					
149	pCUdef	Critical		Passive Central Unit defective	
150	EQPT	Critical	B and ZA (B)	Wrong converter type	
151	FW !	Critical	A and ZA (A)	Firmware faulty	
152	LOS	Critical	B and ZA (B)	LOS at D2in	
153	AIS D2	Critical	B and ZA (B)	AIS at D2in	
154	U_Aux	Minor	ZA (B)	Loss of auxiliary voltage	
155	OvLoad	Minor	B and ZA (B)	Module overloaded	
156	LOC	Minor	B and ZA (B)	No ringing current	
157	ROM !	Minor	B and ZA (B)	Wrong program checksum	
158	RAM !	Minor	B and ZA (B)	Card RAM defective	
159	I_loop	Minor	B and ZA (B)	No loop current	
160	c_n_r	Minor	B and ZA (B)	C-wire not ready, incoming	
161	sh_c	Minor	B and ZA (B)	C-wire, incoming, short-circuited	
162	ConSyn	Minor	B and ZA (B)	No sync in data signal (V.110)	
163	LOSout	Minor	B and ZA (B)	LOS at D2out	
164	Level?	Minor	B and ZA (B)	Level range exceeded	
165	Sensor	Minor	B and ZA (B)	Sensor fault - Hardware fault	
166	P loss	Minor	B and ZA (B)	Pulse loss alarm	
167	SU_act	Minor	B and ZA (B)	Service unit activated	
168	Pvlcor	Minor	EL	Level value out of range	
169	FW !	Minor	B and ZA (B)	Firmware faulty (local)	
171	othErr	Minor	B and ZA (B)	Configuration error with KZU 1 IC	
172	wr.typ	Minor	A and ZA (A)	Wrong converter type	
173	no NSUE	Minor	B and ZA (B)	QD2: No connection to SOA/NSUE	
174	no QD2	Minor	-	No connection to QD2 adapter	

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
175	LOOP	Minor	B and ZA (B)	Converter loop closed	
176	EXLOOP	Minor	EL	External loop closed	
227	INT	Critical	EL	Card-internal fault	
228	LOS F2	Critical	A and ZA (A)	LOS at F2in	
229	AIS F2	Critical	A and ZA (A)	AIS at F2in	
230	LOS F1	Critical	ZA (A)	LOS at F1in	
231	LOF F1	Critical	A and ZA (A)	Loss of sync at F1in	
232	AIS F1	Critical	A and ZA (A)	AIS at F1in	
233	BER3F1	Critical	ZA (A)	BER 10^{-3} at F1in	
234	ExD F1	Minor	A and ZA (A	Ext D at F1in	
235	BER6F1	Minor	A and ZA (A	BER 10^{-6} at F1in	
236	ExN F1	Minor	B and ZA (B)	Ext N at F1in	
237	SvCDef	Minor	B and ZA (B)	Service channel defective	
238	LOOP	Minor	B and ZA (B)	Loop closed	
252	Npossb.	Minor	EL	Action rejected	
253	? Zep!	Minor	-	Central Unit passive	
254	n.used	Minor	-	Sub-address not used	
255	Good	Minor	-	Location OK	
257		Critical		Signal concentrator input	
SDH Expansion					
FU internal					
300	INT-A	Critical	-	Urgent internal fault in function unit	
301	INT-B	Minor	-	Minor internal fault in function unit	
302	Power	Critical	-	Faulty power supply	
304	Timing	Critical	-	Faulty timing source	
305	ICN	Minor	-	Internal communication failure	
SISA-0					
310	INT-A	Critical	-	Urgent internal fault in function unit	
311	INT-B	Minor	-	Minor internal fault in function unit	
312	Power	Critical	-	Faulty power supply	

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
313	Timing	Critical	-	Faulty timing source	
314	Batt	Minor	-	Discharged RAM backup battery	
315	PS	Minor	-	Power supply failure on remote devices	
316	ICN	Minor	-	Fault in internal device controller bus	
SetCentral					
330	LTI	Critical	-	Loss of all inbound timing references	
T0					
331	LT0	Critical	-	T0 internal timing failure	
332	T0Quality	Minor	-	T0 internal timing quality alarm	
333	NMR	Minor	-	No more redundancy	
334	PRe	Minor	-	Pulling range exceeded	
T4					
335	LT4	Minor	-	T4 timing failure	
336	T4Quality	Minor	-	T4 timing quality alarm	
337	NMR	Minor	-	No more redundancy	
TS					
338	LTS	Minor	-	Timing source failure	
OSPI					
339	LOS	Critical	-	Loss of signal	X
340	TX Fail	Minor	-	Transmisson failure	X
341	LPower low	Minor	-	Laser output power too low	
342	LPower high	Minor	-	Laser output power too high	
343	LBIAS high	Minor	-	Laser bias current to high	
RT					
344	LOF	Critical	-	Loss of frame	X
345	SD	Minor	-	Signal degraded	
346	eBER	Critical	-	Excessive bit error ratio	
347	SSF	Minor	-	Server signal failure	

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
348	E1	Minor	-	Faulty orderwire channel	
349	DCCR	Minor	-	Faulty data communication channel, D1-D3	
350	F1	Minor	-	Faulty service channel	
351	J0-Mis	Critical	-	Selection trace mismatch	
352	FB	Minor	-	Fiber break	
MS					
353	msAIS	Critical	-	Multiplex Section AIS	
354	BER-3	Critical	-	Bit error ratio exceeds 10E-3	
355	SD	Minor	-	Bit error ratio exceeds specified threshold	
356	msFEF	Minor	-	Multiplex Section far end Rx failure	
357	E2	Minor	-	Faulty orderwire channel	
358	DCCM	Minor	-	Faulty data communication channel, D1-D12	
359	SSF	Minor	-	Server signal failure	
AU4					
360	auLOP	Critical	-	Loss of pointer	X
361	auAIS	Critical	-	AU-AIS is receive	X
362	MSI-SL	Critical	-	Mismatch of HO path signal label, C2	
363	MIS-PT	Critical	-	Mismatch of HO path trace string, J1	
364	hoFERF	Minor	-	HO path far end Rx failure	
365	SSF	Minor	-	Server signal failure	
366	SD	Minor	-	Signal degraded	
367	UNEQ	Minor	-	Unequipped	
TU3					
368	tuLOP	Critical	-	Loss of pointer	X
369	tuAIS	Critical	-	TU3 pointers contains 'all ones' sequence	X
370	MIS-SL	Critical	-	Mismatch of LO path signal label, C2	

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
371	MIS-PT	Critical	-	Mismatch of LO path string, J1	
372	loFERF	Minor	-	LO path far end Rx failure	
373	SSF	Minor	-	Server signal fail	
374	SD	Minor	-	Signal degraded	
375	UNEQ	Minor	-	Unequipped	
VC4					
383	SSF	Minor	-	Server signal failure	X
384	MIS-SL	Critical	-	Mismatch of HO path signal label, C2	
385	MIS-PT	Critical	-	Mismatch of HO path trace string, J1	
386	hoFERF	Minor	-	HO path far end Rx failure	
387	LOM	Minor	-	Loss of multiframe	
388	SD	Minor	-	Signal degraded	
389	UNEQ	Minor	-	Unequipped	
VC12					
390	SSF	Minor	-	Server signal failure	
391	MIS-SL	Critical	-	Mismatch of LO signal label, V5	
392	MIS-PT	Critical	-	Mismatch of LO path trace string ,J2	
393	loFERF	Minor	-	LO path far end Rx failure	
394	SD	Minor	-	Signal degraded	
395	UNEQ	Minor	-	Unequipped	
PPI					
396	LOS	Critical	-	Loss of signal	
D1					
397	LOF	Critical	-	Loss of frame	
398	AIS	Critical	-	AIS received	
399	BER-3	Critical	-	Bit error ratio exceeds 10E-3	
400	BER-5/6	Minor	-	Bit error ratio exceeds 10E-5/6	
TU12					
381	SD	Minor	-	Signal degraded	

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
382	UNEQ	Minor	-	Unequipped	
410	tuLOP	Critical	-	Loss of pointer	X
411	tuAIS	Critical	-	TU12 pointers contains 'all ones' sequence	X
412	MIS-SL	Critical	-	Mismatch of LO path signal label, V5	
413	MIS-PT	Critical	-	Mismatch of LO path string, J2	
414	SSF	Minor	-	Server signal failure	
415	loFERF	Minor	-	LO path far end receive failure	
420	LOS	Critical		Loss of Signal	X
428	FOP	Minor		Failure of Protocol	
429	SSF-W	Minor		Server Signal Fail, Working	
430	SSF-P	Minor		Server Signal Fail, Protection	
436	SSF	Minor		Server Signal Fail	
437		Minor		Auto Negotiation Failure	
438		Critical		Down (Ethernet Layer Down)	
439		Critical		Down (Ethernet Port Down)	
440		Critical		LFD (Loss of Frame Delineation)	
441		Critical		PLM (Payload Mismatch)	
442		Critical		TLCR (Loss of Total Capacity Receive)	
443		Critical		MIS-GID (Group ID Mismatch)	
444		Minor		PLCR (Loss of Partial Capacity Receive)	
445		Minor		LOSeq (Loss of Sequence)	
446		Critical		LOM (Loss of Multiframe)	
447		Minor		MND (Member Not Deskewable)	
448		Minor		VC(1) Fail	
449		Minor		VC(2) Fail	

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
450		Minor		VC(3) Fail	
451		Minor		VC(4) Fail	
452		Minor		VC(5) Fail	
453		Minor		VC(6) Fail	
454		Minor		VC(7) Fail	
455		Minor		VC(8) Fail	
456		Minor		VC(9) Fail	
457		Minor		VC(10) Fail	
458		Minor		VC(11) Fail	
459		Minor		VC(12) Fail	
460		Minor		VC(13) Fail	
461		Minor		VC(14) Fail	
462		Minor		VC(15) Fail	
463		Minor		VC(16) Fail	
464		Minor		VC(17) Fail	
465		Minor		VC(18) Fail	
466		Minor		VC(19) Fail	
467		Minor		VC(20) Fail	
468		Minor		VC(21) Fail	
469		Minor		VC(22) Fail	
470		Minor		VC(23) Fail	
471		Minor		VC(24) Fail	
472		Minor		VC(25) Fail	
473		Minor		VC(26) Fail	
474		Minor		VC(27) Fail	
475		Minor		VC(28) Fail	
476		Minor		VC(29) Fail	
477		Minor		VC(30) Fail	
478		Minor		VC(31) Fail	
479		Minor		VC(32) Fail	
480		Minor		VC(33) Fail	
481		Minor		VC(34) Fail	
482		Minor		VC(35) Fail	
483		Minor		VC(36) Fail	

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
484		Minor		VC(37) Fail	
485		Minor		VC(38) Fail	
486		Minor		VC(39) Fail	
487		Minor		VC(40) Fail	
488		Minor		VC(41) Fail	
489		Minor		VC(42) Fail	
490		Minor		VC(43) Fail	
491		Minor		VC(44) Fail	
492		Minor		VC(45) Fail	
493		Minor		VC(46) Fail	
494		Minor		VC(47) Fail	
495		Minor		VC(48) Fail	
496		Minor		VC(49) Fail	
497		Minor		VC(50) Fail	
498		Minor		VC(51) Fail	
499		Minor		VC(52) Fail	
500		Minor		VC(53) Fail	
501		Minor		VC(54) Fail	
502		Minor		VC(55) Fail	
503		Minor		VC(56) Fail	
504		Minor		VC(57) Fail	
505		Minor		VC(58) Fail	
506		Minor		VC(59) Fail	
507		Minor		VC(60) Fail	
508		Minor		VC(61) Fail	
509		Minor		VC(62) Fail	
510		Minor		VC(63) Fail	
512		Minor		SSF (Server Signal Fail)	
513		Critical		MIS-SL (Mismatch of LO path signal label, C2)	
514		Critical		MIS-PT (Mismatch of LO path trace string, J1)	
515		Minor		loFERF (LO path far end receive error)	
516		Minor		SD (Signal degrade)	

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
517		Minor		UNEQ (Unequipped)	
518		Critical		CSF (Client Signal Failure)	
519		Critical		feCSF (Far End Client Signal Failure)	
520		Critical		TLCT (Loss of Total Capacity Transmit)	
521		Minor		PLCT (Loss of Partial Capacity Transmit)	
522		Minor		NMR (No more redundancy)	
SHDSL					
600		Critical		Card: End point configuration failure during startup	
601		Critical		Card: Failure during configuration	
602		Minor		Card: SW Incompatibility	
607		Critical		Card: Not equipped	
608		Critical		Link: Failure during configuration	
609		Minor		Link: Inconsistent number of repeaters	
610		Minor		Link: Remote Loop active	
611		Minor		Link: No more PM Resources available	
612		Minor		Link: DiagnosticMode has been enabled by the user	
616		Critical		Link: LOS (Loss Of Signal)	
617		Critical		Link: LOSWF (Loss Of Signal Word)	
618		Minor		Link: No Peer Detected	
619		Minor		Link: No NT Detected	
620		Minor		Link: Signal Degraded (BER5/6)	
621		Critical		Link: Excessive Bit Error Rate (BER3)	
622		Minor		Link: Segment error	
623		Minor		Link: SNR margin Alarm	

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
624		Critical		Link E1: LOF (Loss of Frame)	
625		Critical		Link E1: AIS received	
626		Critical		Link E1: excessive BER (10E-3)	
627		Minor		Link E1: degraded signal (10E-5/6)	
628		Minor		Link E1: N-Bit received _	
629		Minor		Link E1: D-Bit received	
630		Critical		Link E1: LOS (Loss of Signal)	
631		Minor		Link E1: CRC4	
632		Minor		NTE DSL: BER5/6	
633		Minor		NTE DSL: SNR margin alarm	
634		Critical		NTE DSL: Failure during configuration	
635		Minor		NTE DSL: SW/HW Incompatibility	
636		Minor		NTE DSL: Error during software distribution	
640		Critical		NTE E1: LOS/LOF	
641		Critical		NTE E1: AIS received	
642		Critical		NTE E1: excessive BER (10E-3)	
643		Minor		NTE E1: degraded signal (10E-5/6)	
648		Critical		Rep.1: Failure during configuration	
649		Minor		Rep.1: SNR margin Alarm NS	
650		Minor		Rep.1: excessive BER (10E-5/6) NS	
651		Critical		Rep.1: Loss of Signal, Loss of Frame CS	
652		Minor		Rep.1: SNR margin Alarm CS	
653		Minor		Rep.1: excessive BER (10E-5/6) CS	

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
654		Minor		Rep.1: SW/HW Incompatibility	
655		Minor		Rep.1: Error during software distribution	
656		Critical		Rep.2: Failure during configuration	
657		Minor		Rep.2: SNR margin Alarm NS	
658		Minor		Rep.2: excessive BER (10E-5/6) NS	
659		Critical		Rep.2: Loss of Signal, Loss of Frame CS	
660		Minor		Rep.2: SNR margin Alarm CS	
661		Minor		Rep.2: excessive BER (10E-5/6) CS	
662		Minor		Rep.2: SW/HW Incompatibility	
663		Minor		Rep.2: Error during software distribution	
664		Critical		Rep.3: Failure during configuration	
665		Minor		Rep.3: SNR margin Alarm NS	
666		Minor		Rep.3: excessive BER (10E-5/6) NS	
667		Critical		Rep.3: Loss of Signal, Loss of Frame CS	
668		Minor		Rep.3: SNR margin Alarm CS	
669		Minor		Rep.3: excessive BER (10E-5/6) CS	
670		Minor		Rep.3: SW/HW Incompatibility	
671		Minor		Rep.3: Error during software distribution	
672		Critical		Rep.4: Failure during configuration	
673		Minor		Rep.4: SNR margin Alarm NS	

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
674		Minor		Rep.4: excessive BER (10E-5/6) NS	
675		Critical		Rep.4: Loss of Signal, Loss of Frame CS	
676		Minor		Rep.4: SNR margin Alarm CS	
677		Minor		Rep.4: excessive BER (10E-5/6) CS	
678		Minor		Rep.4: SW/HW Incompatibility	
679		Minor		Rep.4: Error during software distribution	
680		Critical		Rep.5: Failure during configuration	
681		Minor		Rep.5: SNR margin Alarm NS	
682		Minor		Rep.5: excessive BER (10E-5/6) NS	
683		Critical		Rep.5: Loss of Signal, Loss of Frame CS	
684		Minor		Rep.5: SNR margin Alarm CS	
685		Minor		Rep.5: excessive BER (10E-5/6) CS	
686		Minor		Rep.5: SW/HW Incompatibility	
687		Minor		Rep.5: Error during software distribution	
688		Critical		Rep.6: Failure during configuration	
689		Minor		Rep.6: SNR margin Alarm NS	
690		Minor		Rep.6: excessive BER (10E-5/6) NS	
691		Critical		Rep.6: Loss of Signal, Loss of Frame CS	
692		Minor		Rep.6: SNR margin Alarm CS	
693		Minor		Rep.6: excessive BER (10E-5/6) CS	

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
694		Minor		Rep.6: SW/HW Incompatibility	
695		Minor		Rep.6: Error during software distribution	
696		Critical		Rep.7: Failure during configuration	
697		Minor		Rep.7: SNR margin Alarm NS	
698		Minor		Rep.7: excessive BER (10E-5/6) NS	
699		Critical		Rep.7: Loss of Signal, Loss of Frame CS	
700		Minor		Rep.7: SNR margin Alarm CS	
701		Minor		Rep.7: excessive BER (10E-5/6) CS	
702		Minor		Rep.7: SW/HW Incompatibility	
703		Minor		Rep.7: Error during software distribution	
704		Critical		Rep.8: Failure during configuration	
705		Minor		Rep.8: SNR margin Alarm NS	
706		Minor		Rep.8: excessive BER (10E-5/6) NS	
707		Critical		Rep.8: Loss of Signal, Loss of Frame CS	
708		Minor		Rep.8: SNR margin Alarm CS	
709		Minor		Rep.8: _excessive BER (10E-5/6) CS	
710		Minor		Rep.8: SW/HW Incompatibility	
711		Minor		Rep.8: Error during software distribution	
SOX alarms					
1000	-	Critical	-	Node configuration different from database. Expected config. ID differs from current config. ID	

Table 6.G: List of alarms

ALARM NO.	SHORT DESIG.	SEVERITY	LED ON SIGN. PANEL AND ALARM CONTACT	ALARM DESCRIPTION	DEFAULT FOR ALARM-REROUTING
1001	-	Minor	-	Alarms purged. Alarm memory cleared; alarms partly deleted	
2001	-	Minor	-	Overflow in alarm handling. Messages were lost	
2002	-	Minor	-	Connection to database broken	
2003	-	Critical	-	Alarm(s) lost. Alarms were lost due to 2002	
2004	-	Minor	-	Test alarm	
2005	-	Minor	-	Alarm reaction failed	

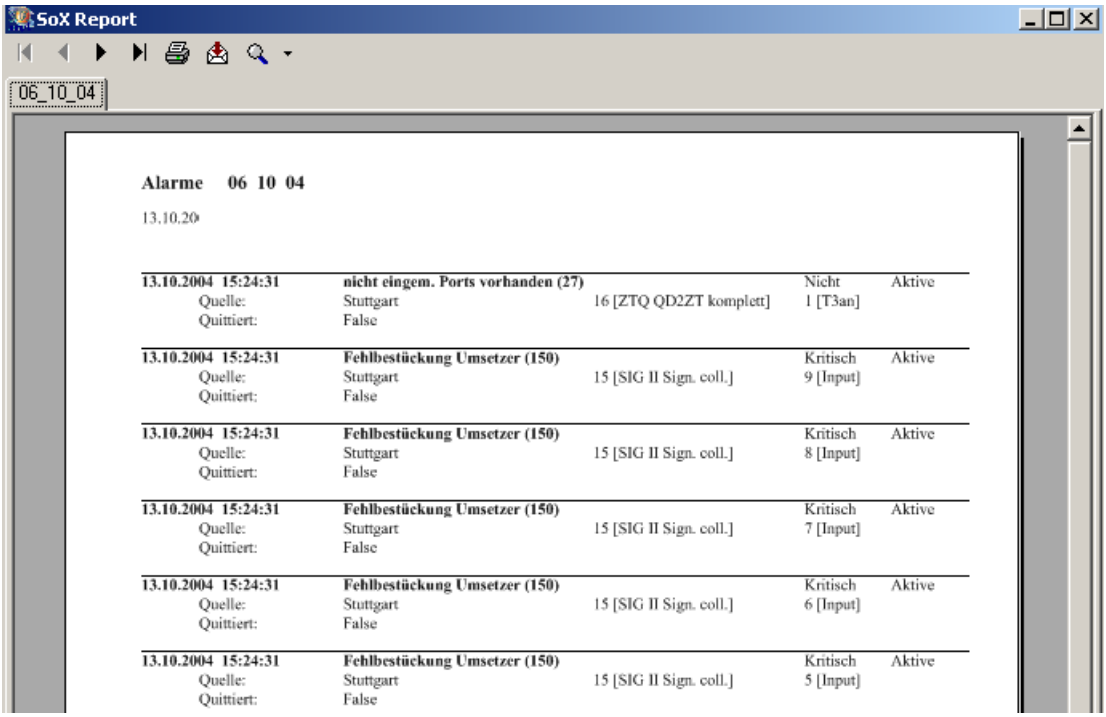
6.8.2 Alarm report

For documentation purposes, you can generate an alarm report. This alarm report covers all alarms included in the alarm list. The alarm report can be printed out or exported to a file.

For exporting, you can select the following file types:

- Adobe Acrobat (*.pdf)
- Microsoft Excel (*.xls)
- Microsoft Word (*.doc)
- Rich Text Format (*.rtf)

The following screenshot shows an example of an alarm report.

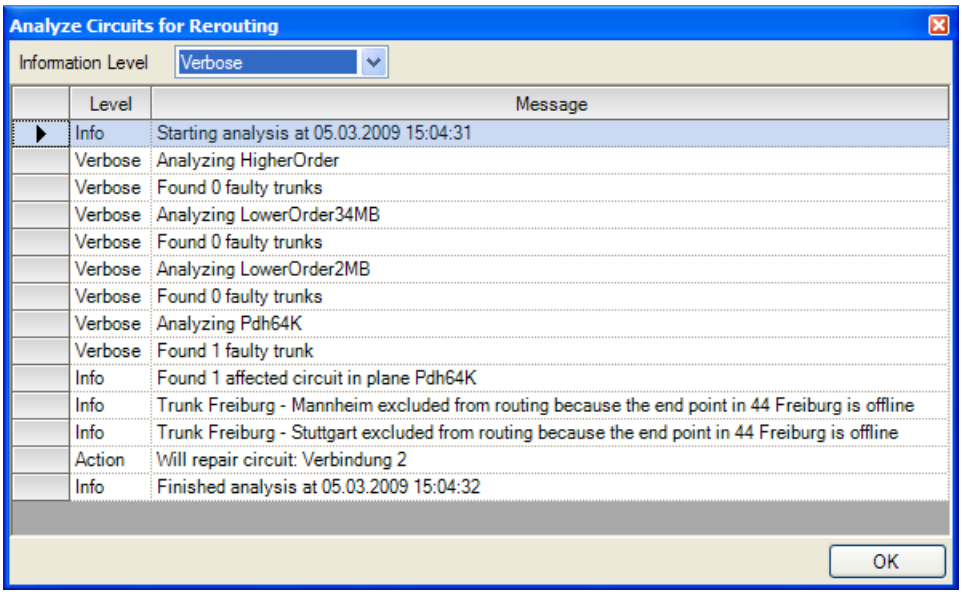

SoX Report
06_10_04
Alarme 06 10 04
13.10.20
13.10.2004 15:24:31 nicht eingem. Ports vorhanden (27) Nicht Aktive
Quelle: Stuttgart 16 [ZTQ QD2ZT komplett] 1 [T3an]
Quittiert: False
13.10.2004 15:24:31 Fehlbestückung Umsetzer (150) Kritisch Aktive
Quelle: Stuttgart 15 [SIG II Sign. coll.] 9 [Input]
Quittiert: False
13.10.2004 15:24:31 Fehlbestückung Umsetzer (150) Kritisch Aktive
Quelle: Stuttgart 15 [SIG II Sign. coll.] 8 [Input]
Quittiert: False
13.10.2004 15:24:31 Fehlbestückung Umsetzer (150) Kritisch Aktive
Quelle: Stuttgart 15 [SIG II Sign. coll.] 7 [Input]
Quittiert: False
13.10.2004 15:24:31 Fehlbestückung Umsetzer (150) Kritisch Aktive
Quelle: Stuttgart 15 [SIG II Sign. coll.] 6 [Input]
Quittiert: False
13.10.2004 15:24:31 Fehlbestückung Umsetzer (150) Kritisch Aktive
Quelle: Stuttgart 15 [SIG II Sign. coll.] 5 [Input]
Quittiert: False

6.9 Rerouting at Alarms

As of SOX Version 5.5 the alarm rerouting is supported. This function can be executed manually at a Single/Multi user system and automatically at a Multi user system. With this function it is possible to reroute circuits which are affected by alarms. For this Trunks are monitored for appropriate alarms. Which faults are activating the rerouting function is defined in the alarm list. The list of the alarms you can find in chapter Section 6.8.1, *Alarm list* . The alarms are marked in the column “Default for Alarm rerouting” with an X.

Trunks/Circuits which shall be taken into account for rerouting must be configured. This configuration will be done during the configuration of the Trunks/Circuits via the "Trunks" or "Circuits" menu -> "Annotations & Routing" -> "Automatic routing" using the "Eligible for Rerouting on Alarms" function check box. For circuits additonally a "Priority for Routing" can be configured. This priority is used for rerouting on alarms and will be taken into account during the analysis. The higher the priority is the rather the circuit will be taken into account for rerouting.

At the appearance of one of the predefined alarms at a Trunk configured for "rerouting" the system carries out an analysis on possible redirections. With this analysis informations about the affected Trunks/Circuits will be determined. The result of this analysis provides the possible rerouting. The result is displayed in a information window. In this information window you can specifiy the details of information which shall appear.



Note: Rerouting on alarms is non-revertive. This means that there is no switchback after the switch criterion is no longer available.

Single user system

The analysis for “Rerouting on Alarms” must be carried out manually via the „Special Tasks“ menu. The analysis provides the result for possible rerouting. With the “Reroute Circuits with Alarms” menu the circuits will be rerouted.

Note: With a single user system "rerouting" must be carried out manually

Multi user system

For a multi user system it is possible to configure that the „Reroute on Alarms function can be carried out automatically. The configuration will be done via the “Tree View” -> "Areas" -> "Rerouting on Alarms Service" menu.

Prerequisites

Carrying out the "Rerouting on Alarms" function automatically a service is used. This service can be started either manually or automatically.
If the service starts up, in the "SOXServer" mask a user will be added in the "Client and Exclusive Access" table.

Trunks and circuits which shall be taken into account for „Rerouting on Alarms“ must be configured as „Eligible for Rerouting on Alarms”.

The system is ready to perform the „Rerouting on Alarms“ function if these prerequisites are fulfilled.

The system starts with a analysis after the appearence of an alarm on a Trunk which is configured for "Rerouting".

With this analysis on all levels (HigherOrder, Lower Order) the faulty Trunks will be determined. Depending on the faulty Trunks the affected Circuits will be determined.

Note: Network elements which are locked by other users will not be taken into account for the analysis.

Now the system finds out a new way for the circuits. The new way will be found out with the following criterias.

1. Costs - The path to the destination causing the lowest costs is determined.
2. Similar ways; this is the way which is similarly to the previously way and thus less reconfiguration must be performed.
3. Bottlenecks - The path with the lowest number of bottlenecks is identified, i.e. the higher the number of trunks between the nodes, the higher the probability that one of these trunks will be used.
4. Trunk filling - The trunks are always filled up to their maximum time slot usage before an empty trunk will be used.

The connections concerned are then rerouted on the new way. The rerouting of the connections will be carried out in the following order:

1. Circuits with the highest Routing priority
2. nx64 kbit/s circuits
3. single 64 kbit/s circuits

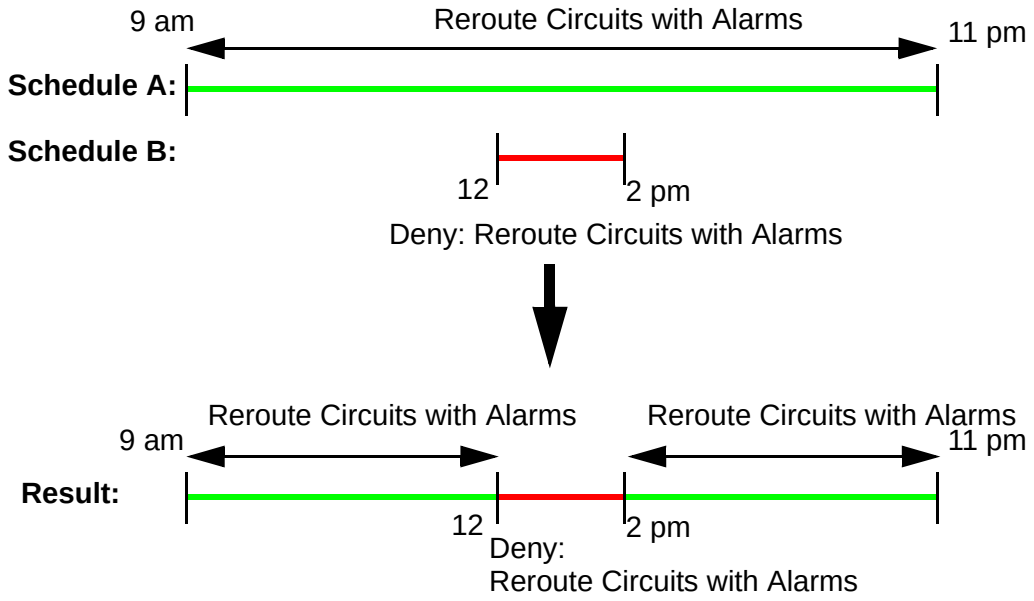
Depending on the result of the analysis all Network elements affected by the rerouting will be locked for other users. Afterwards the configuration of the changed network elements will be transmitted as broadcast to the network and activated. Then the configuration is stored to the database. The lock of the network elements concerned is reset again.

In case of a failure e.g. the configuration cannot be loaded to the network and activated a reload of the database will be performed. Thus the old configuration is still available.

With a multi user system the "Rerouting on Alarms" function can also be performed manually. This will be done in the same way as for a single user system.

Time-dependent Rerouting on Alarms

Time-dependent "Rerouting on Alarms" of connections can also be configured. You can define whether alarm rerouting shall be performed or not.



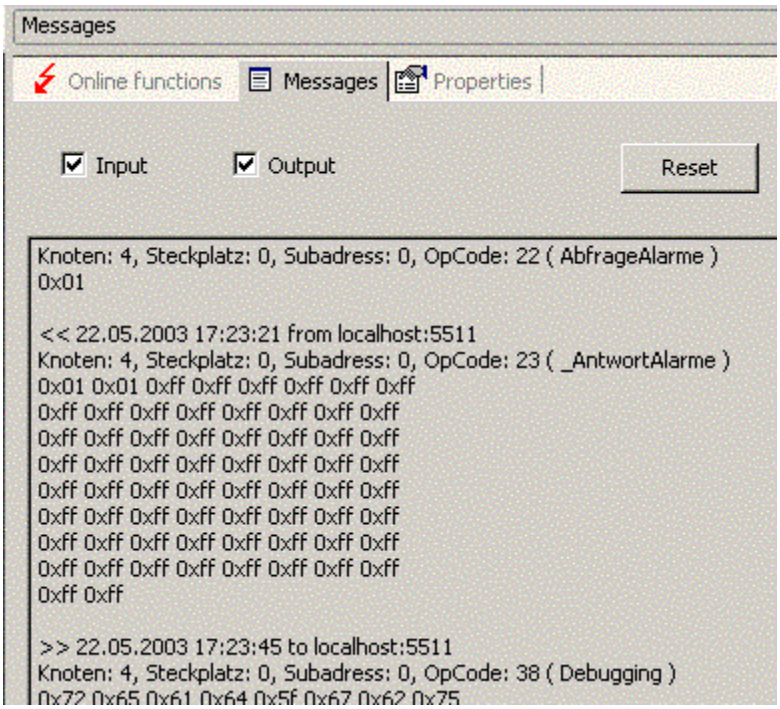
6.10 Messages

Messages exchanged between the SOX and network can be displayed. This is possible by means of the "Messages" function. Using this function, both incoming messages (Input) and outgoing messages (Output) can be displayed.

Input: Messages sent from the network to SOX.

Output: Messages sent from SOX to the network.

The following screenshot shows an example of such messages.


Messages
Online functions
Messages
Properties
Input
Output
Reset
Knoten: 4, Steckplatz: 0, Subadress: 0, OpCode: 22 (AbfrageAlarme)
0x01
<< 22.05.2003 17:23:21 from localhost:5511
Knoten: 4, Steckplatz: 0, Subadress: 0, OpCode: 23 (_AntwortAlarme)
0x01 0x01 0xff 0xff 0xff 0xff 0xff 0xff
0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
0xff 0xff
>> 22.05.2003 17:23:45 to localhost:5511
Knoten: 4, Steckplatz: 0, Subadress: 0, OpCode: 38 (Debugging)
0x72 0x65 0x61 0x64 0x5f 0x67 0x62 0x75

Chapter 7
Network Control Using ServiceOn Access

The present chapter describes how XMP1 can be controlled and monitored by the ServiceOn Access Network Management System.

For more detailed information, please refer to the Operator Manuals for ServiceOn Access and the Operating Instructions for the SOX MSP Software.

The XMP1 Flexible Multiplexer can be connected to a TMN in different ways. One of them involves the connection to a SISA network. This technology described below has been used since several years.

7.1 Introduction to the SISA Network

The SISA network (**S**upervisory and **I**nformation **S**ystem for local and remote **A**reas) is used for information exchange (alarms, commands, measuring values etc.) between transmission systems and an operating system. In conjunction with XMP1, the ServiceOn Access Network Management System from Ericsson is used.

Messages from local or remote transmission systems, i.e. the so-called network elements (NE) are transmitted to the ServiceOn Access workstations. Moreover, information (e.g. control commands, requests etc.) are sent out by the ServiceOn Access Network Management System to the network elements. Thus, the individual network elements can be controlled and monitored.

A SISA network (DCN=Data Communication Network) always has a tree topology based on the master/slave principle and is hierarchically structured. This hierarchical structure is set up using concentrators. Fulfilling a master function, concentrators permit the connection of further network elements (slaves). Regarding the structure, slaves are located directly below the associated master. A slave - working as concentrator - can act in turn as master for the next lower level. This principle results in the tree structure mentioned above. This tree structure can be composed of up to nine hierarchy levels. Thus, a concentrator works as both master and slave, i.e. within the hierarchy it acts as slave in the upward direction and as master in the downward direction.

Concentrators can be implemented either on a hardware (SISA-K) or software basis. The latter are referred to as virtual concentrators (SISA-V).

The individual slaves are physically connected to the QD2int bus specified according to RS485 and operating at a bit rate of 64 kbit/s. This bus is appropriate for connecting up to 30 network elements.

In order to provide redundancy, it is possible to set up ring structures in a SISA network.

The connection of the SISA network to the LAN/WAN of the ServiceOn Access Network Management System is set up via a QD2 gateway. ServiceOn Access can be connected to several QD2 gateways.

The following figure shows the principle described above:

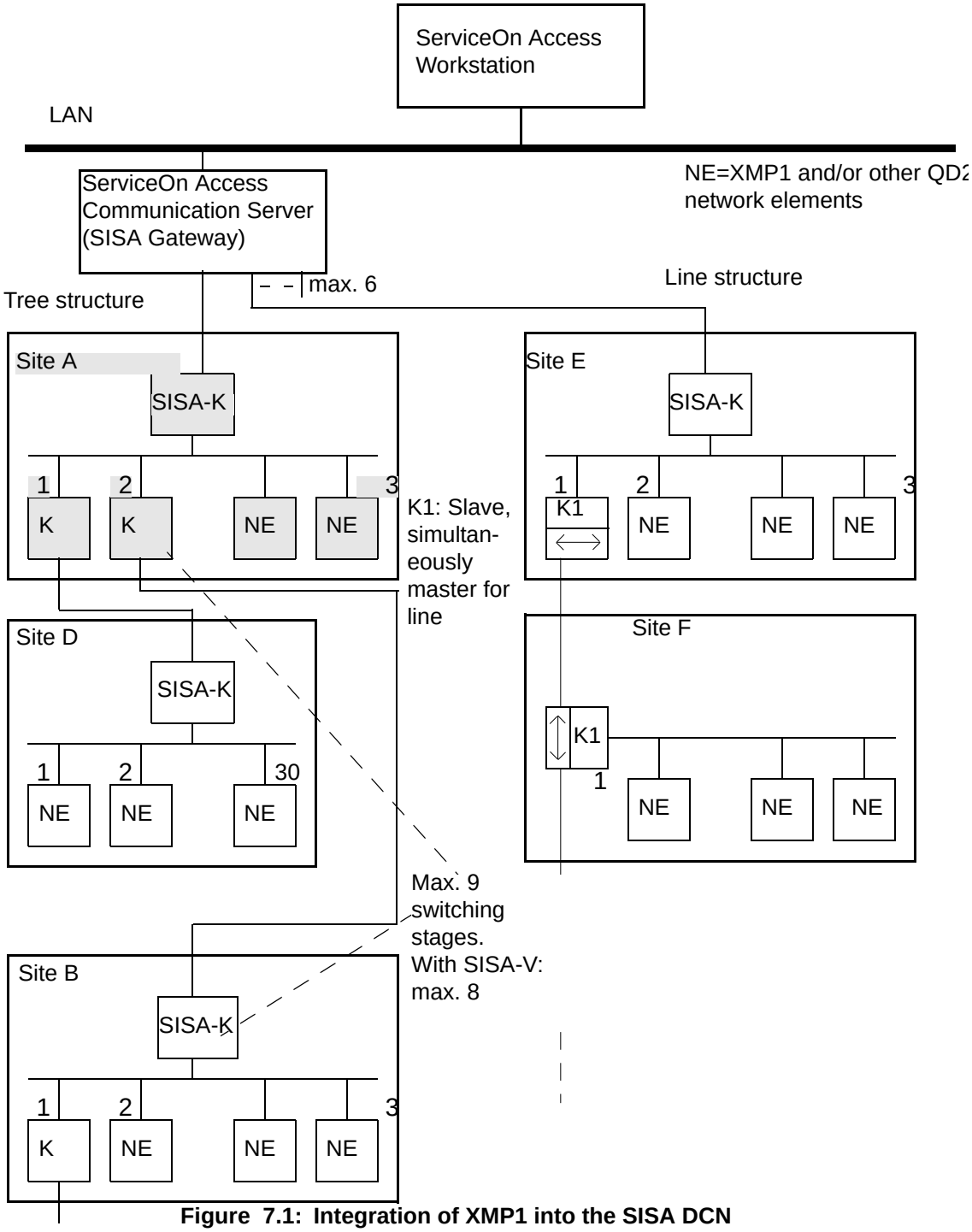


Figure 7.1: Integration of XMP1 into the SISA DCN

7.1.1 XMP1 as network element

Within a TMN, the XMP1 node is considered as network element. Normally, a network element is composed of several units which can be addressed individually. It is possible to regard the network element from a logic functional or an equipment view.

In the QD2 standard, the normal XMP1 network element is addressed as CCM1/0 (equipment version 40)(1=2 Mbit/s, 0=64kbit/s) representing a plesiochronous cross-connect multiplexer of hierarchy level 1. When using a MUX 34 module, it is addressed as CCM3/1/0 (equipment version 41).

An XMP1 with the SDH expansion is treated as a PDH NE with SDH expansion (equipment version 43).

Equipment view of the XMP1 network element

The equipment with modules indicates the hardware components of a network element. These components are referred to as plug-in modules.

Logic view of the XMP1 network element

The XMP1 Flexible Multiplexer is divided up into various functional sub-units, the so-called functional groups (FG). These include SDH modules, port modules, clock supply, KZU module, data modules etc.. This permits a hardware-independent view. A higher-order network management system such as ServiceOn Access "sees" the network element from this view. The sum of all functional groups forms the functional model.

All SISA information is managed by the so-called SISA-0.

7.1.2 Connecting options

For connecting a PDH network element to a network management system, a Q-interface complying with ITU-T M.3010 is used.

In the XMP1 Flexible Multiplexer, this Q-interface is made available by the QD2 Central Unit or the QD2 adapter. Due to the data exchange with the Central Unit functions, the respective QD2 part provides the convertible information and configuration data at the Q-interface.

An optional Ethernet interface located on the Central Unit permits access to the network management system over IP.

During the initial commissioning process, the node must be informed on the SISA-0 address of the QD2 section. This is done using the Local Service PDA.

Three variants are available for setting up the connection to a higher-order network management system.

- IP
- RS485 bus
- ECC64
- ECC8

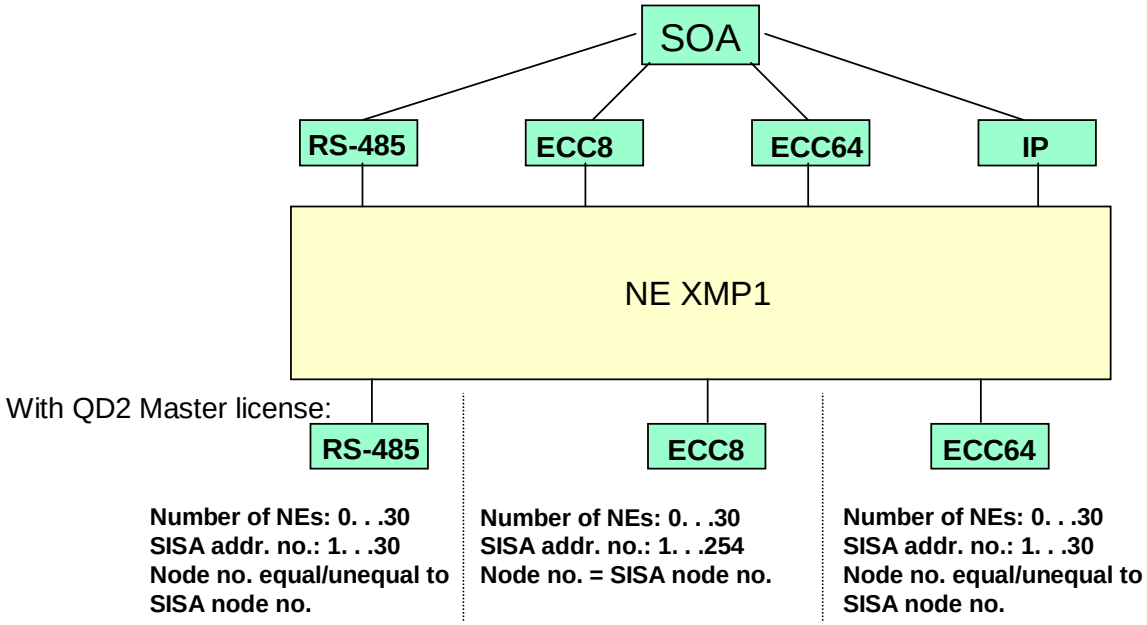
  Note: The network element that provides access to SOA must only be connected with one of the described variants to SOA.

Optionally, the following connection options can be implemented in the downward hierarchical order by means of the QD2 Master function (with license):

- RS485 bus
- ECC64
- ECC8

Please note that a connection using this function is possible only if the latter has not yet been used for the connection setup in the SOA direction.

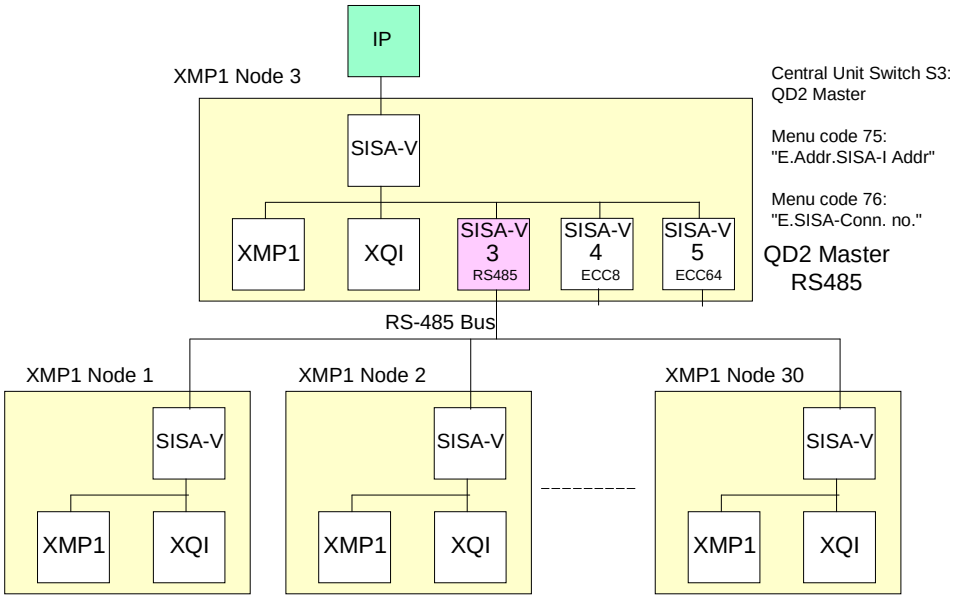
		SOA direction			
		RS-485	ECC8	ECC64	IP
Downward hierarchical order	RS-485	-	X	X	X
	ECC8	X	-	X	X
	ECC64	X	X	-	X



Connection via the RS485 bus (optional)

According to EIA-RS-485, the QD2 bus interface is designed for connecting up to 30 network elements with an own QD2 interface.

If the node is configured as QD2 Master (hardware setting on the Central Unit, Switch S3), another SISA-V (3) appears below the SISA-V. Up to 30 NEs can be connected to this SISA-V (3) via the RS-485 bus. The SISA address area ranges from 1 to 30. The node number can be identical with or differ from the SISA node number.

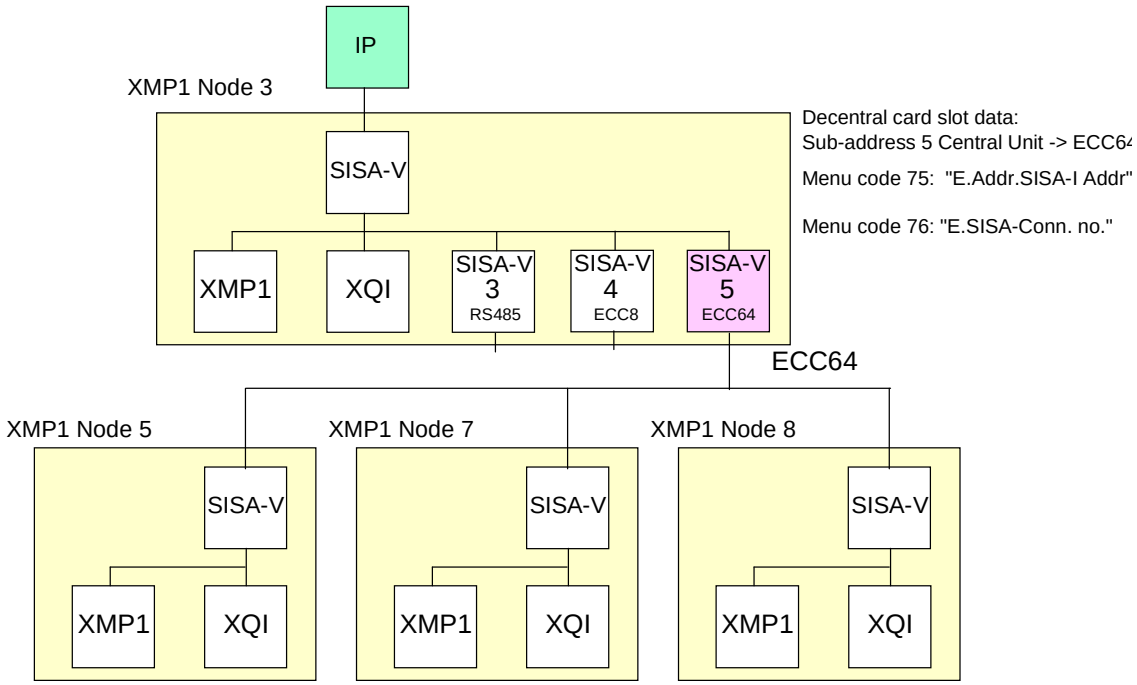


ECC64 (optional)

In this operating mode, a SISA network can be set up within the XMP1 network by switching a digital 64 kbit/s conference.
The access node to SOA is configured as ECC64 Master. In this case, another SISA-V (5) appears below the SISA-V. Up to 30 network elements can be addressed via this SISA-V (5). The ECC64 Master function is adjusted via the decentral card slot information of sub-address 5 of the Central Unit.

When configuring the ECC64 Master node, the DIX module must be provided via the software. In the ECC64 Master node, the 64 kbit/s conference channel must be linked with sub-address 8 of the DIX module.

The SISA address area ranges from 1 to 30. The node number can be identical with or differ from the SISA node number.



Connection via ECC8) (optional)

An alternative option, which permits the management channel to be routed in the XMP1 network, is the use of ECC8 with a data rate of 8 kbit/s. In this case, the management information is transmitted in time slot 0 of the PCM frame (E1) in bits 7 and 8. This must be taken into consideration during network planning with regard to the expected performance.

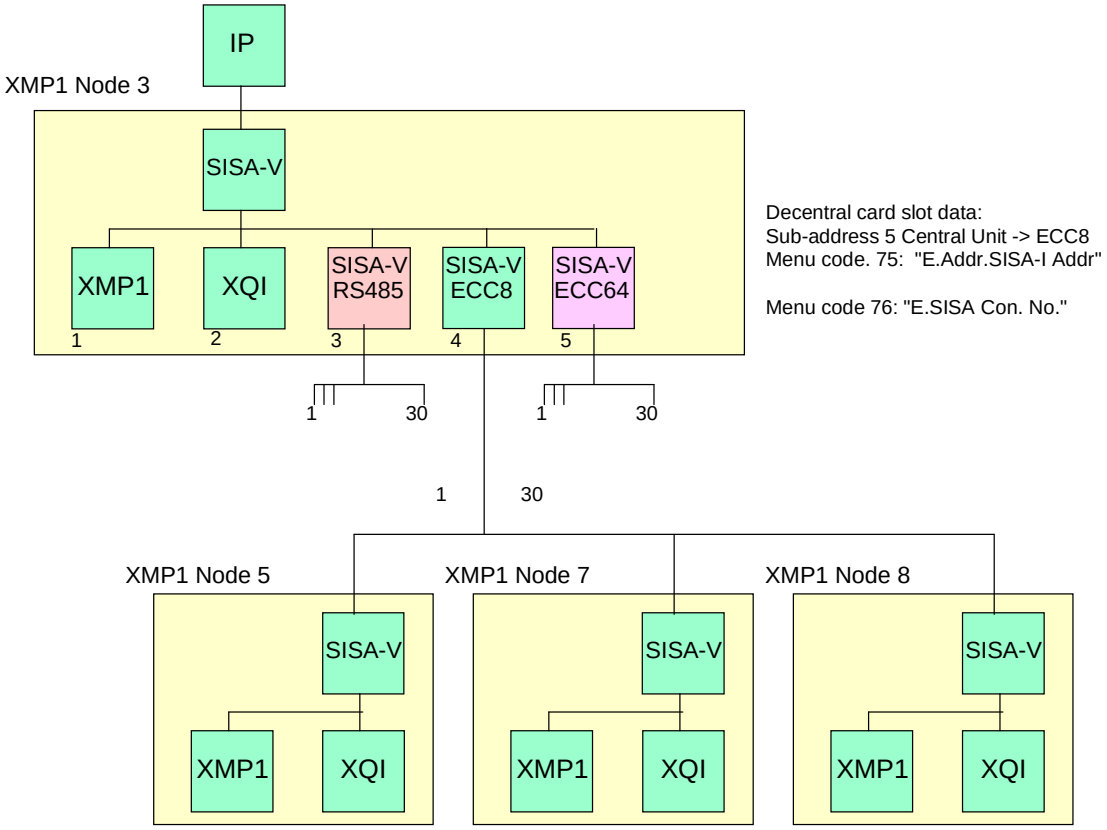
The node number and SISA node number must be identical in this case.

For performance reasons, each sub-network connected via ECC8 should not include more than 30 nodes. The range of numbers used as node numbers and SISA node numbers is 1....254 for these nodes.

> **Note:** For performance reasons, an SDH node should always be connected over IP.

The access node must not include a service channel (DK) routed via RS232 if it shall be connected to SOA over IP. This access node must only be connected over IP. If the SOX network management system shall be connected to the RS232 interface, the setup of a service channel via RS232 must be prevented. For this purpose, in the card-specific settings of the Central Unit, Switch 2 (QD2 Adapter Simulation) must be set. This setting can be made by means of the LSP or SOX MSP.

The schematic diagram depicted below shows an example of such an application.
In this example, node 3 is the access node to SOA and is configured as ECC8 Master. SISA-V of node 3 communicates with the SOA SISA-I. This configuration is performed via the decentral card slot data of the Central Unit - info no. xx "ECC8".
In addition, the IP address of the computer running the SISA-I process, must be configured via menu item 75 "E.Addr.SISA-I Addr" of the ABM. The SISA-I access number is configured via menu item 76 "E.SISA-Conn. No.". If the node is configured as ECC8 Master, a SISA-V (4) appears underneath the SISA-V. This indicates that ECC8 is used as management channel. In this case, the management information is transmitted via this SISA-V (4) to the SISA-V from where it is passed on to SISA-I.


IP
XMP1 Node 3
SISA-V
XMP1
XQI
SISA-V RS485
SISA-V ECC8
SISA-V ECC64
1
2
3
4
5
1
30
1
30
1
30
Decentral card slot data:
Sub-address 5 Central Unit -> ECC8
Menu code. 75: "E.Addr.SISA-I Addr"
Menu code 76: "E.SISA Con. No."
XMP1 Node 5
XMP1 Node 7
XMP1 Node 8
SISA-V
SISA-V
SISA-V
XMP1
XQI
XMP1
XQI
XMP1
XQI

7.1.3 Commissioning

The initial commissioning and new commissioning of XMP1 network expansions of version 5.1 and higher is executed using the SOX MSP. The commissioning process of the entire network element is performed according to the operating instructions of the individual modules and depending on the performance features of the SOX MSP version used.

The Central Units available in the individual nodes receive their configuration information via the F-interface using a download process executed by the SOX MSP application. This information is then distributed to the individual modules in the node. The Q-interface receives the required information and converts it in compliance with the QD2 standard.

After commissioning, the XMP1 network is controlled, configured and monitored by the ServiceOn Access Network Management System.

SOX MSP can also be used subsequently to modify or expand the node. For this purpose, the node configuration data must be read out from node. After modifying the data these must be downloaded again to the node and activated in the latter.

> **Note:** Depending on the type of modification, the QD2 section of the QD2 Central Unit or QD adapter will execute a reset in order to activate the new configuration. This reset is signalled to the ServiceOn Access Network Management System. For this reason, it might be necessary to update open ServiceOn Access windows.

7.1.4 Functional model

Like every network element, the XMP1 also provides a SISA-0 functionality. A Plesiochronous Equipment Timing (PET) process is used for clock recovery. The switching matrix function is provided by a Bottom Path Connection 64kbit/s (BPX 64). The relevant functional groups are no separate modules, but only Central Unit functions.

The function groups depicted with a dashed line border in the diagram below are belonging to the SDH section of XMP1.

These are based on the QD2 information model as per "July 1995". Some important functional groups are described in the following sections.

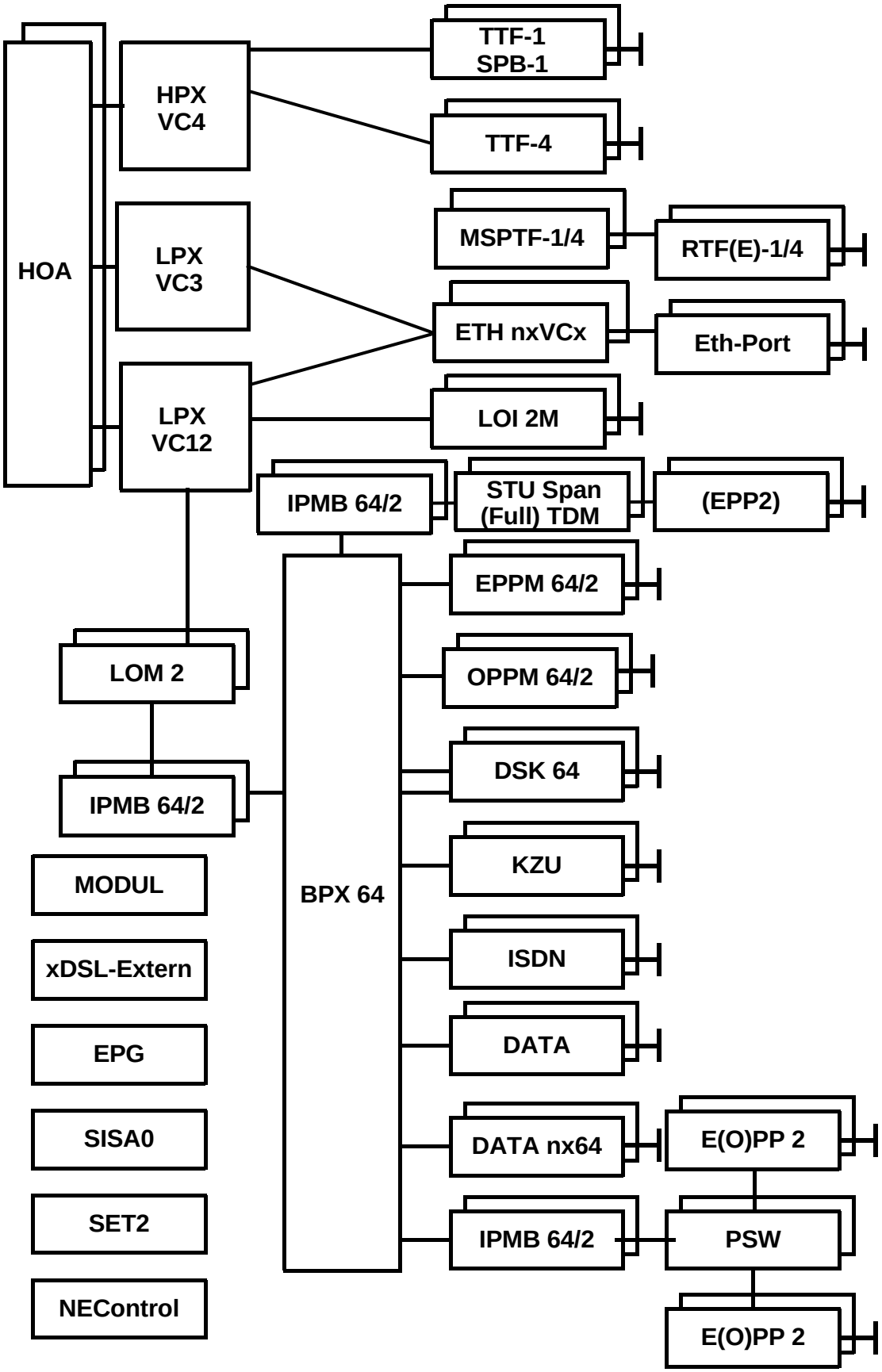


Figure 7.2: QD2 information model

7.2 Configuration Using the SOX MSP

7.2.1 General

The SOX MSP is a windows-based software which has been specially developed for the configuration and operation of the XMP1 node.

The Service PC requires the LMT Operator Terminal XMP1 for SOX MSP (V5.1) and SOX MSP Software.

The Service PC is connected to the XMP1 node. The LMT software is started and a connection to the network is set up via the network view. The network view permits the XMP1 nodes integrated in the QD2 infrastructure to be addressed.
The connection can be set up serially or via TCP/IP. After the successful connection setup, an MSP and possibly a XQI2 appears underneath the SISA-0. The SOX software is started up by activating the XMP1 application.

The SOX MSP application can also be used for the offline configuration of the XMP1 node without a direct connection to the latter.

7.2.2 Functional units of the SOX MSP software

The SOX MSP software supports the complete configuration of a node on the one hand, while all operating functions supported by the XMP1 node can be executed on the other.

Functions

- Complete node configuration, i.e. equipment with modules
- Support of all previous XMP1 modules
- Complete configuration of all modules
- Configuration of all connection types possible
- Configuration of CC8 connections most frequently used
- Configuration of clock priorities
- Support of the following online functions (operator functions):
  - Node status request
  - Firmware status request
  - Co-channel radio alignment
  - Loopback switching
  - Line test
  - Debugging
  - Request of remote inventory data
  - Setting node passwords
  - Display of signal concentrator statuses and controlling outputs
- Readout of configuration data from the node and file
- Saving configuration data in the node and to file
- Reports for alarms, configuration

- Support of the signal concentrator card, display of signal statuses and manual control of output relays.

Chapter 8
Mechanical Design, Equipment and Cabling

8.1 Design

Three different types of XMP1 subracks are available for mounting plug-in modules. They differ from each other with respect to their number of card slots.

- XMP1 Subrack (16), see Section 8.1.1, *XMP1 Subrack (16), XMP1 Subrack (8)*
- XMP1 Subrack (8), see Section 8.1.1, *XMP1 Subrack (16), XMP1 Subrack (8)*
- XMP1 Subrack (16/32), Section 8.1.2, *XMP1 Subrack (16/32)*

8.1.1 XMP1 Subrack (16), XMP1 Subrack (8)

The 19" XMP1 subrack with 7 height units (HU) can be installed both in 19" and ETS racks or cabinets.

XMP1 Subrack type (16) offers 16 identical card slots, while XMP1 subrack type (8) provides eight card slots for plug-in modules. The individual modules are interconnected via the backplane.

Note: For installation in ETS racks, the flanges must be turned.

DESIGNATION	PART NO.	NOTE
XMP1 Subrack (8)	BFD 101 028/1	with front panel, Color RAL5007 brilliant blue
XMP1 Subrack (16)	BFD 101 029/1	
XMP1 Subrack (16/32)	BFD 101 030/1	

Note: Never operate the XMP1 system without its front panel mounted.

The following figure shows an XMP1 subrack (16) with its front panel mounted.

Figure 8.1: XMP1 subrack

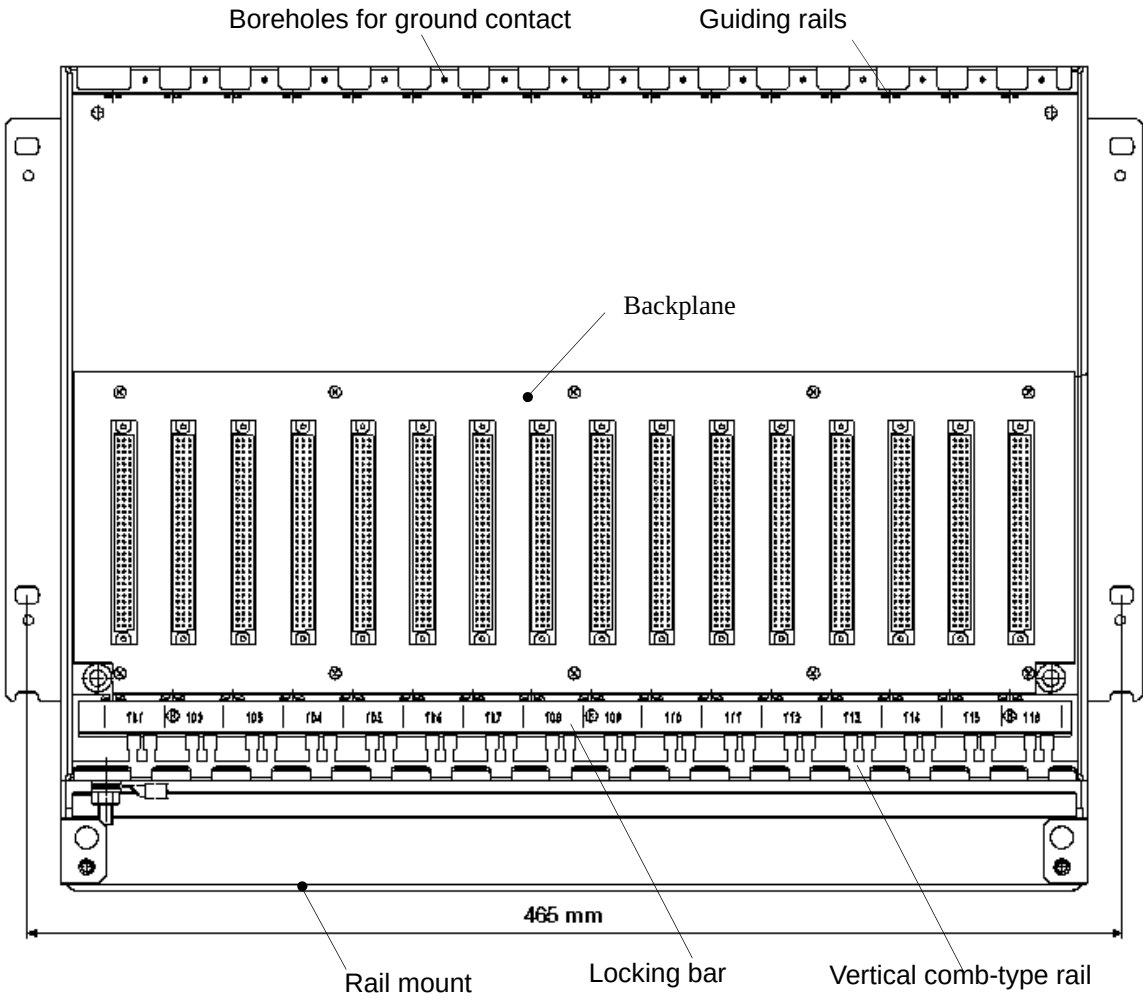
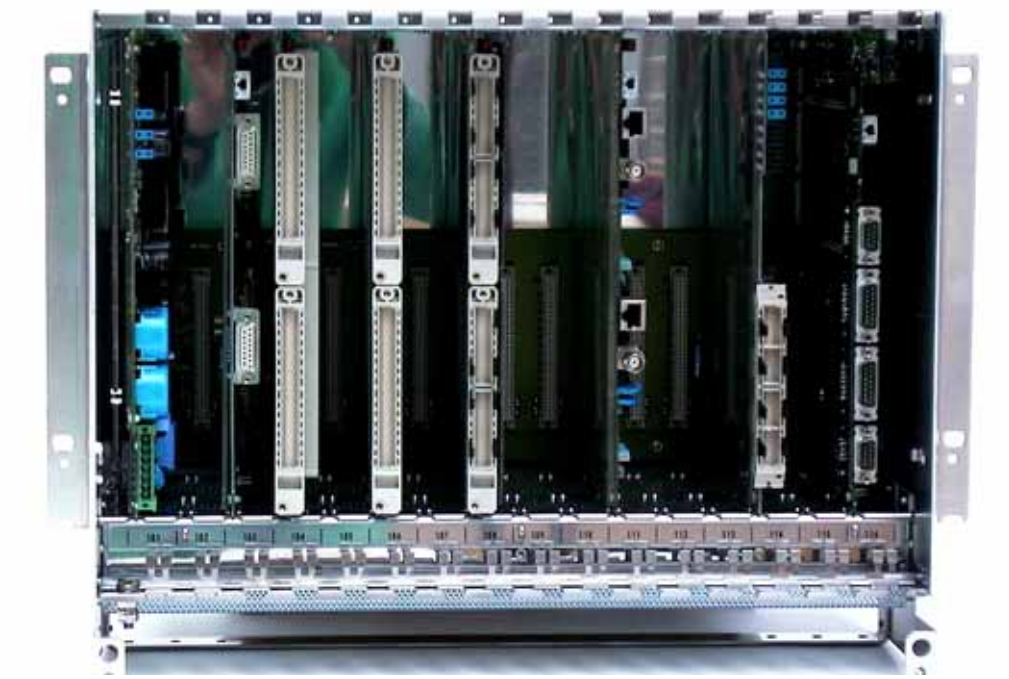
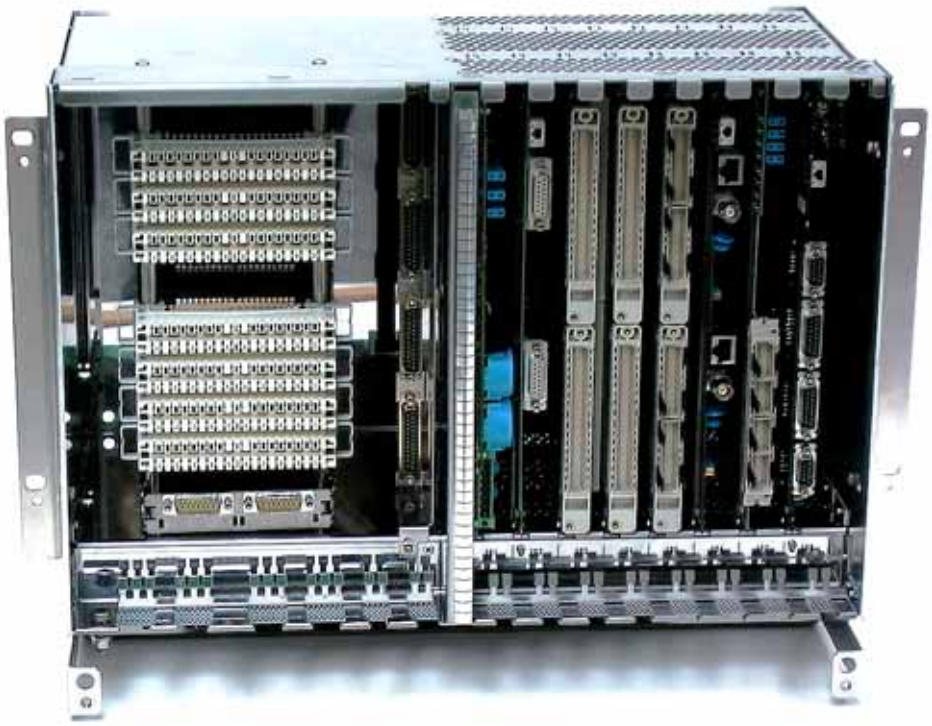


Figure 8.2: View of the open XMP1 subrack (16)

The following figure shows the open XMP1 subrack (16).



The following figure shows the open XMP1 subrack (8). The left-hand section of the XMP1 subrack includes the distribution strips (LSA-Plus strips) and trapezoidal connectors.



Space for distribution strips
(LSA-Plus strips) and trapezoidal connectors

Figure 8.4: View of an open XMP1 subrack (8)

8.1.2 XMP1 Subrack (16/32)

XMP1 subrack (16/32) (BFD 101 030/1) can be doubled to provide card slots for up to 32 modules. The connection between two XMP1 subracks (16/32) is set up using a connecting kit. The latter includes a cable duct and a connecting cable.

Tab. 8.A: XMP1 subrack (16/32)

DESIGNATION	PART NO.	NOTE
XMP1 Subrack (16/32)	BFD 101 030/1	For cascading, with front panel
Bus termination	62.7026.140.00-A001 AN00016711	For XMP1 subrack (16/32), required twice per node
Connection kit W 19“	62.7026.910.00-A001 AN00009054	For interconnecting two XMP1 subrack (16/32)

Note: Interconnection of a XMP1 subrack (16/32) with a XMP1 subrack (8) or XMP1 subrack (16) is not possible.

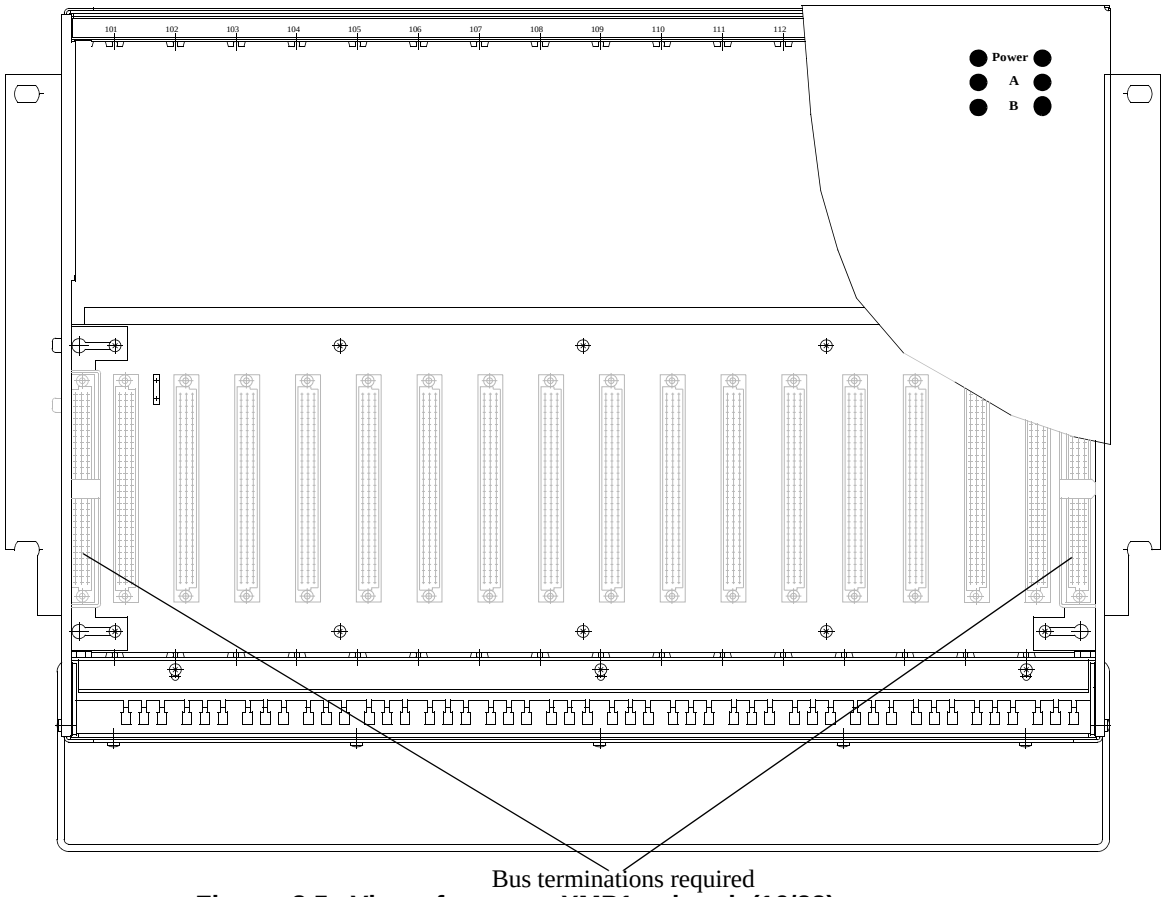


Figure 8.5: View of an open XMP1 subrack (16/32)

8.1.3 Modules

The modules are composed of PCBs 250 mm high and 210 mm wide. They are connected to the backplane wiring of the XMP1 subrack via 64/96-pin plug connectors. Since all modules have a uniform connector assignment to the bus line on the backplane, the XMP1 subrack can be freely equipped.
The only exception is made by the Central Unit (and the redundant Central Unit). The latter must always be mounted in the extreme right of the XMP1 subrack. The corresponding openings for LEDs are provided in the front panel.
Plug connectors F1 and F2 as well as the signal and power supply wiring are located on the front side of the modules.

8.2 Equipment with Modules

8.2.1 Central Units

Depending on the individual case of application, the XMP1 node must be equipped with different Central Units. These must always be mounted in the extreme right of the XMP1 subrack.
Thus, in XMP1 subrack (16), the Central Unit must be mounted in card slot 16 and in XMP1 subrack (8), it must be mounted in card slot 8.

Table 8.B: Central Units

XMP1 EQUIPPED FOR	CENTRAL UNIT	PART NO.	CARD SLOTS IN XMP1 SUBRACK (16)	CARD SLOTS IN XMP1 SUBRACK (8)
Operation in a complex network with ServiceOn Access	Central Unit CC/QD2	62.7040.310.00-A001 AN00102460	16	8
Operation in a complex CC network	Central Unit CC	62.7040.320.00-A001 AN00102461	16	8
Operation as terminal/add-drop station in the basic network	Central Unit GN	62.7040.330.00-A001 AN00102462	16	8
Operation as terminal/add-drop station in the basic network with ServiceOn Access	Central Unit GN/QD2	62.7040.335.00-A001 AN00239607	16	8

Operation in a complex CC network with QD2 interface

If the XMP1 Flexible Multiplexer is operated in a complex CC network monitored and managed by the ServiceOn Access Network Management System, the Central Unit CC/QD2 (AN00102460) must be provided.

Operation in a complex CC network

If the XMP1 Flexible Multiplexer is operated in a complex CC network, the Central Unit CC (AN00102461) or Central Unit CC/QD2 (AN00102460) is required.

Operation as terminal/add-drop station in the basic network

If the XMP1 Flexible Multiplexer is operated as terminal or add-drop station in a basic network, the Central Unit GN (AN00102462) is required.

Operation as terminal/add-drop station in the basic network with QD2 interface

If the XMP1 Flexible Multiplexer is operated as terminal or add-drop station in a basic network monitored and manged by the ServiceOn Access, the Central Unit GN/QD2 (AN00239607) is required.

8.2.2 Redundancy modules

Each Central Unit can be doubled. The redundant Central Unit is identical with the active Central Unit and must be mounted in the card slot next to it (card slot 7 / 15 or 31).

Note: In the Operator Software, the appropriate Central Unit to be mounted as redundant Central Unit, e.g. "ZT2 QD2ZT doubled", must be selected using the 'Standby Modules' dialog.

8.2.3 Ethernet adapter

From XMP1 version 4.x onwards the Central Units CC and GN can optionally be equipped with the Ethernet adapter module (AN00114784; 62.7040.303.00-A001). This module provides an Ethernet interface for connecting the Central Unit to a LAN. Thus, access to the XMP1 network becomes possible with ServiceOn XMP1 (SOX) via IP. The IP configuration can take place manually (LSP/WINLSP) or via a BootP/DHCP server.

8.2.4 CU-E sub-module

When using the SDH expansion, the Ethernet interface is provided by the CU-E sub-module (05HBA00006AAX). This sub-module is mounted on the Central Unit.

8.2.5 Bus terminations

Bus terminations are not required for XMP1 subracks (16) and (8). These are integrated in the backplane.

For XMP1 subrack (16/32), two bus terminations must be provided.

8.2.6 Port modules

The following port modules are available:

Table 8.C: Port modules

DESIGNATION	PART NO.
2 MBIT/S PORTS	
Port (4), with 4 HDB3 interfaces, 120 Ohms and 75 Ohms	62.7026.350.00-A001 AN00059056
Port (2), with 2 HDB3 interfaces, 120 Ohms and 75 Ohms	62.7026.353.00-A001 AN00059057

Table 8.C: Port modules

DESIGNATION	PART NO.
Port Nx64k (V.11) with V.11 interface	62.7040.340.00-A001 AN00218363
Port Nx64k (V.11 + V.35) with V.11/V.35 interfaces	62.7040.340.00-A002 AN00224736
Port LE2 OPT U	62.7026.530.00-A001 AN00043311
- Module 2F (1270 to 1340 nm), (25 dB)	62.7026.570.00-A001 AN00120461
- Module 1F (Transmitter: 1270 to 1330 nm; Receiver: 1510 to 1590 nm)	62.7026.580.00-A001 AN00120463
- Module 1F (Transmitter: 1510 to 1590 nm; Receiver: 1270 to 1330 nm)	62.7026.580.00-A002 AN00120464
Port LAN, with two channels 10BaseT	05HAT00051AAH
Port LAN, with one channel 10BaseT	05HAT00051ABA
34 MBIT/S PORTS	
Port MUX34 KX, 34 Mbit/s interface, 6 dB (75 Ohms, coaxial)	62.7026.810.00-A002 AN00117366
Interface, additional module for Port MUX 34 for connecting 12 external 2 Mbit/s signals	62.7026.820.00-A002 AN00118166
Port LE34OPT KX, opt. line equipment 34 Mbit/s, 1310 nm	62.7026.830.00-A002 AN00118666

8.2.7 Power supply unit

The following power supply is available for supplying the modules with the necessary operating voltages:

Table 8.D: Power supply unit

DESIGNATION	IDENT. NO.
PSU XMP1	05HAT00080AAB

8.2.8 SDH expansion

The modules required for the SDH expansion of the XMP1 system are listed in the following table.

Tab. 8.E: Components of SDH expansion

DESIGNATION	IDENT. NO.	NOTE
SCU (SDH Core Unit)	**05HAN00121AAJ**	-
CU-E (Central Unit Expansion) with IB cable	**05HBA00006AAX**	Expansion module for Central Units version V3.0 and higher
SDH optics		
STM-1		
STM-1 S1.1 SH 1300	05HAM00088AAW	
STM-1 L1.1 LH 1300	05HAM00089AAY	
STM-1 L1.2 LH 1550	05HAM00090AAU	
STM-4		
STM-4 S4.1 SH 1300	05HAM00091AAW	
STM-4 L4.1 LH 1300	05HAM00092AAY	
STM-4 L4.2 LH 1550	05HAM00093AAB	
SIFU with SDH electr.		
STM-1 EL	05HAM00107AAE	with SFP electr.
STM-1 Patch 2 m	05HAM00108ACR	with patch cable 2 m
Front panel		
SCU-FP (SDH Core Unit Front Panel)	05HBA00013AAG	Connecting panel for two SCUs in redundancy configurations.

8.2.9 Ethernet expansion

The modules required for the Ethernet expansion of the XMP1 system are listed in the following table.

DESIGNATION	IDENT. NO.	NOTE
EoSCU (Ethernet over SDH Core Unit)	05HAN00367AAV	-
CU-E (Central Unit Expansion) with IB cable	05HBA00006AAX	Expansion module for Central Units version V3.0 and higher
Ethernet SFP		
100Base TX elektrical	2401292-0013	RJ45, 100 m
100Base FX	1400800-0011	1300 nm, 0-13 dB/2 km
STM-1 S1.1 100Base LX10	1400729-0027	1300 nm, 0-10 dB/10 km
STM-1 SFPs optical		
STM-1 SFP S1.1 SH 1300	1400729-0027	
STM-1 SFP L1.1 LH 1300	1400744-0051	
STM-1 SFP L1.2 LH 1550	1400744-0044	
STM-4 SFPs optical		
STM-4 SFP S4.1 SH 1300	1400744-0010	
STM-4 SFP L4.1 LH 1300	1400744-0028	
STM-4 SFP L4.2 LH 1550	1400744-0036	
STM-1 SFP elektrical		
STM-1 SFP EL	9500001-0017	
Front panel		
SCU-FP (SDH Core Unit-Front Panel)	05HBA00013AAG	Connecting panel for two EoSCUs in redundancy configurations.

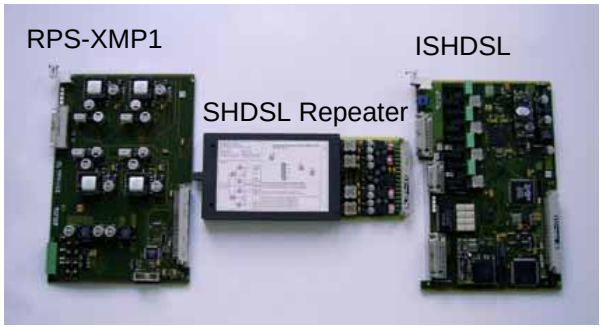
Note:
Only the SFPs listed in the table may be used in the XMP1 system.

8.2.10 Video modules

The following modules are available for transmitting video signals.

DESIGNATION	IDENT. NO.	NOTE
Video encoder (2)	05HAT00063AAC	2 x video-in
Video decoder (2)	05HAT00062AAA	2 x video-out

8.2.11 SDSL Line Equipment

DESIGNATION	IDENT. NO.	NOTE
ISHDSL (4)	05HAT00070AAL	four SDSL IF., four external E1 IF four internal 2Mbit/s IF FSP IF. to connect the RPS-XMP1 module
RPS-XMP1 Remote Power Supply module	05HAT00071AAN	four Remote power supply voltages -116 V
SHDSL Repeater Module	05HBA00123AAD	PCB SHDSL Repeater
SHDSL Repeater unit UG	05HAN00442AAL	Repeater unit SHDSL UG (PCB + housing)
		
Sleeves		
WAM PCM L104, underground installation	AN00814296	
WZG PCM 4L, outdoor installation	AN00059006	

8.2.12 Channel modules

The following channel modules are available:

Table 8.F: Channel modules

MODULE TYPE	IDENT. NO.
KZU CHANNEL INTERFACE MODULES	
KZU OSX (4), 4 interfaces configurable as SU, EX, OB and OBG	05HAT00035AAL
KZU SUB (8), with eight interfaces	05HAT00073AAS
KZU EX (8), with eight interfaces	62.7040.210.00-A002 AN00274683
KZU FEK (8), with eight interfaces	62.7040.250.00-A001 AN00113903
DSK DATA INTERFACE MODULES	
DSK modular, basic board for mounting 4 modules of any type	62.7040.400.00-A002 AN00228158
-Module V.11, two V.11 interfaces	62.7040.405.00-A001 AN00098224
-Module V.24, two V.24 interfaces	62.7040.410.00-A001 AN00098225
-Module V.35, two V.35 interfaces	62.7040.415.00-A001 AN00098226
-Module G.703, two G.703 interfaces	62.7040.420.00-A001 AN00098228
-Module WT, two WT interfaces	62.7040.425.00-A001 AN00099104
-Module G.703 contradirectional, two G.703 interfaces	62.7040.435.00-A001 AN00227950
ISDN INTERFACE MODULES:	
ISDN S0F, with remote power supply and four interfaces	62.7040.610.00-A001 AN00102511
ISDN UK0F (Q), with remote power supply and four interfaces	62.7040.670.00-A001 AN00111549
CONCENTRATOR	
Signal concentrator (16in, 8out)	62.7040.180.00-A001 AN00275454

8.3 ServiceOn XMP1 - License

Table 8.G: ServiceOn XMP1 - License

DESIGNATION	LICENSE NUMBERS	NOTES
SOX NMS (BASIC20)	05PHS00007ACT	License for 20 nodes
SOX NMS (BASIC40)	05PHS00008ACV	License for 40 nodes
SOX NMS (BASIC70)	05PHS00009ACX	License for 70 nodes
SOX NMS (BASIC100)	05PHS00010ACT	License for 100 nodes
SOX NMS (CLASSIC200)	05PHS00011ACV	License for 200 nodes
SOX NMS (CLASSIC300)	05PHS00012ACX	License for 300 nodes
SOX NMS (PREMIUM)	05PHS00013ACA	unlimited license
SOX LCT	05PHS00014ACC	LCT License
SOX MSP	05PHS00037ACP	MSP License
SOX Multiuser Upgrade SW Key	FAL 104 8125	

Every license contains

- License note
- Dongle
- SOX-CD

8.4 Mounting the Modules in the XMP1 Subrack

The modules are for exclusive use in the XMP1 system. Installation and settings must be executed by appropriately trained specialists and service personnel.
Settings on modules may be performed only after extraction of the corresponding modules from the XMP1 subrack.

CAUTION

Observe handling instructions.
Components sensitive to electrostatic discharge.
To protect the components from electrostatic charging, always wear a grounding wristband while you are working on the modules.

The modules can be plugged into the card slot without any tools. Guiding rails available in the XMP1 subrack facilitate the plug-in process.
Both the insertion and extraction of a module must be signalled to the system.
This is done by plugging in the connecting cables or setting an activation switch on the front side of the module.

To mount the module:

First check the settings of switches and jumpers available on the module.

- Loosen the mounting screws of the locking bar. Then push it down.

Module w/o activation switch:

- Insert the module in the XMP1 subrack. Plug in the connecting cable and secure it by means of screws.

Module with activation switch:

- Set the activation switch to position 1. Insert in the module in the XMP1 subrack. Plug in the connecting cable and secure it by means of screws.
  Then set the activation switch to position 2.
- Push up the locking bar and secure it by means of screws.

Further steps ...

- Screw on the grounding bracket.
- Push up the locking bar and secure it by means of screws.

Connecting cable

- Carefully strip the insulation in the area of the terminal strip below the modules (do not destroy the braided shield!).
- Secure the cable in position using a cable tie. Ensure that there is a good electrical contact between the shield and metallic comb rail. There must be a highly conductive connection between the braided shield and XMP1 subrack.
- Connect the interface cable. The module logs on to the Central Unit of the node.

To extract the module:

- Remove the interface cable (if available). The module logs off from the central unit of the node.
- Loosen the cable tie at the comb rail and remove the cable.
- Loosen the mounting screws of the locking bar and push it down.
- Remove the grounding bracket (if available).

Module w/o activation switch:

- Pull out the connecting cables and extract the module from the XMP1 subrack.

Module with activation switch:

- Before you pull out the module, set the activation switch to position 1. Remove the connecting cable and pull out the module.
- Push up the locking bar and secure it by means of screws.

8.5 SOX Connection

The connection of SOX to the network can be set up via a F-interface or Ethernet interface (optional).

8.5.1 F-interface

The connection to the SOX computer is established via connector X3 (F-interface) of the Central Unit using a connecting cable.

The connecting cable to be used for this purpose is V.24/V.28.

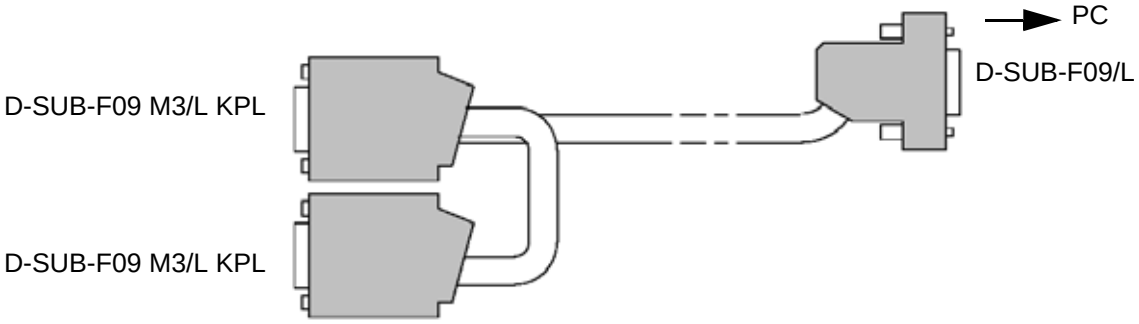
This connecting cable is available in two different versions with different lengths.

Tab. 8.H: ZT <-> RS1 connecting cable

VERSION	IDENT NO.	LENGTH
Conn. Cable, V.24/V.28	1301681-0015	5 m
Conn. Cable, V.24/V.28	1301682-0014	10 m

Central Unit redundancy

For Central Unit redundancy, the Y-connecting cable type V.24/V.28 must be used.



This connecting cable is available with a length of 10 m.

Tab. 8.I: Y-connecting cable V.24/V.28

VERSION	IDENT. NO.	LENGTH
Y-Conn. Cable, V.24/V.28; 10m	1301683-0013	10 m

8.5.2 Ethernet interface

An Ethernet interface for connecting the NMS is provided by the Ethernet Adapter sub-module or - with the SDH expansion - by the CU-E (Central Unit Expansion) sub-module.

For using the Ethernet interface, the Central Unit must therefore be equipped with an Ethernet Adapter (AN00114784, 62.7040.303.00-A001) or - with the SDH expansion - with the CU-E sub-module (05HBA00006AAX).

For this purpose, the connecting cable type Ethernet is required.

RJ45-8pin, shielded RJ45-8pin, shielded

This connecting cable is available in two different versions with different lengths.

Tab. 8.J: Ethernet connecting cable

VERSION	IDENT. NO.	LENGTH
Conn. Cable Ethernet	1301679-0019	5 m
Conn. Cable Ethernet	1301680-0016	10 m

Note: A crossed cable is required to set up a direct connection to a PC.

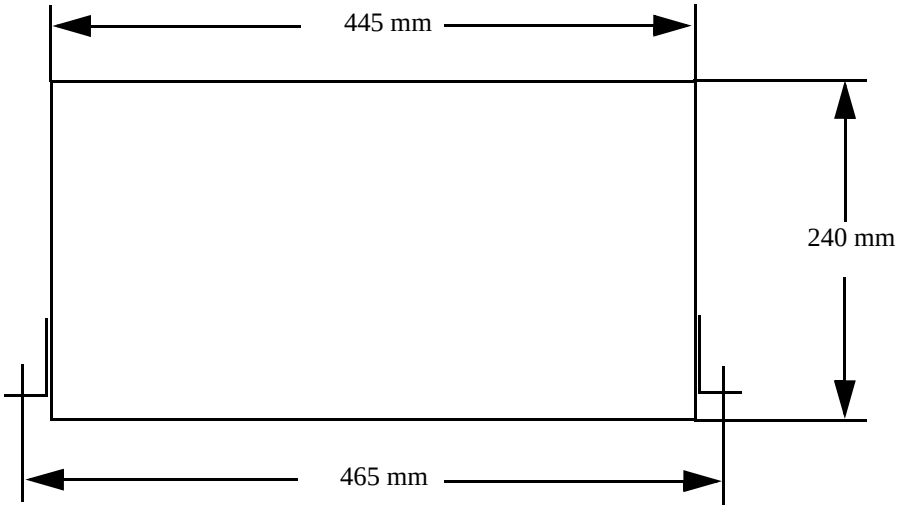
8.6 XMP1 Subrack Installation

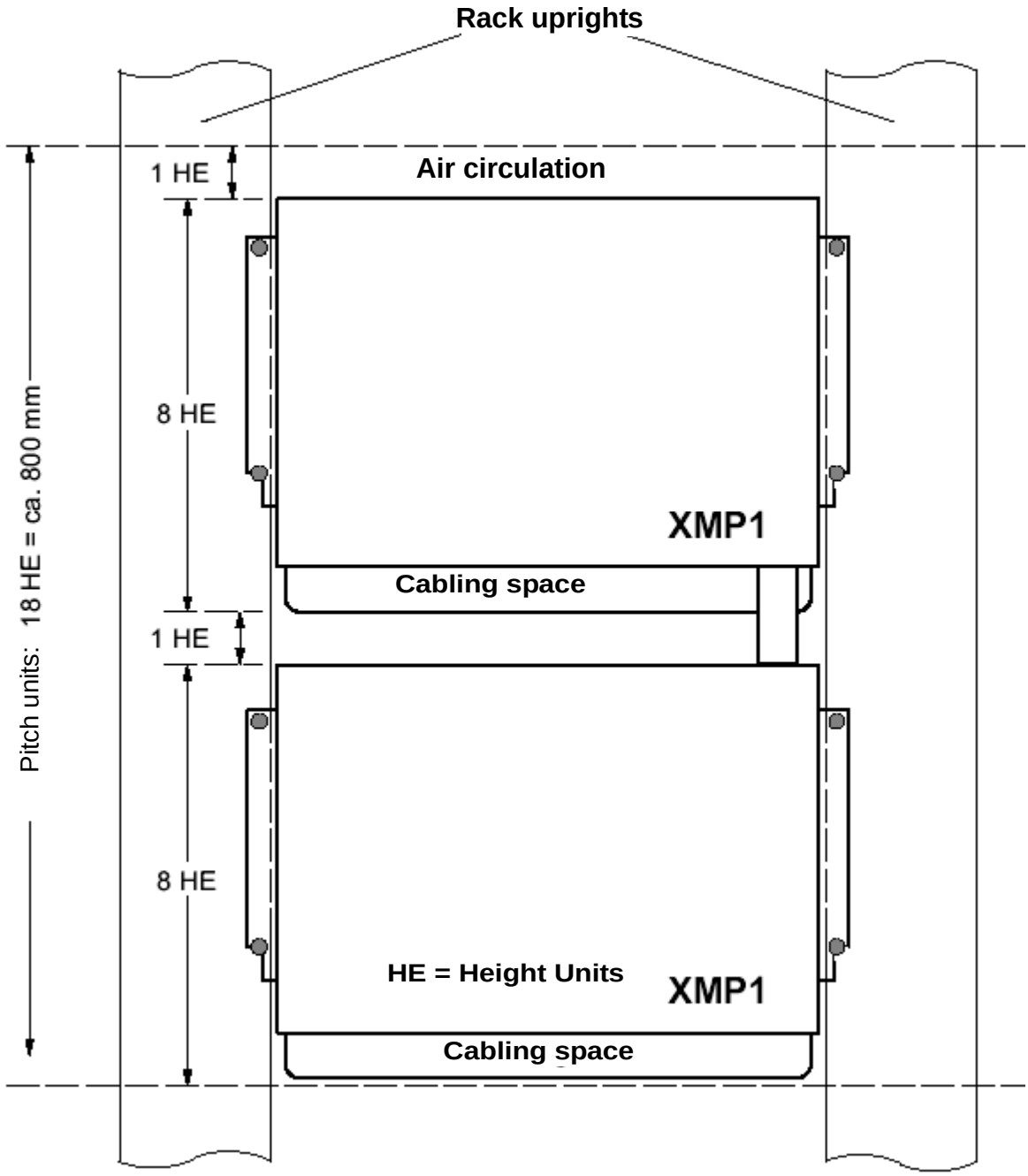
8.6.1 19" cabinets

The XMP1 subrack (8), (16) is appropriate for being mounted in 19" cabinets (with/without swing-out frame).

The XMP1 subrack (8), (16) is secured in the cabinet or rack by means of cage nuts. For more detailed information, please refer to Section 8.7, *XMP1 Subrack Grounding* .

Mounting dimensions in 19“ rack



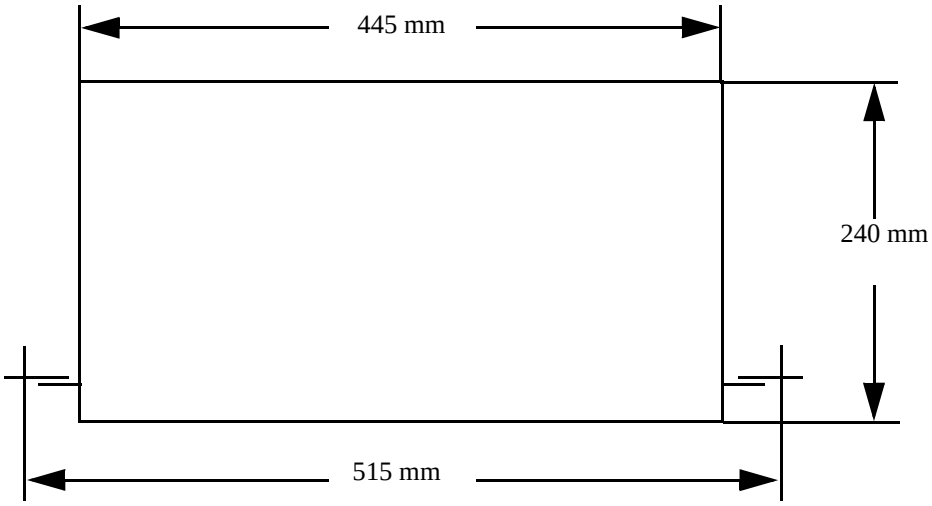

Rack uprights
Air circulation
1 HE
8 HE
XMP1
Cabling space
1 HE
8 HE
HE = Height Units
XMP1
Cabling space
Pitch units: 18 HE = ca. 800 mm

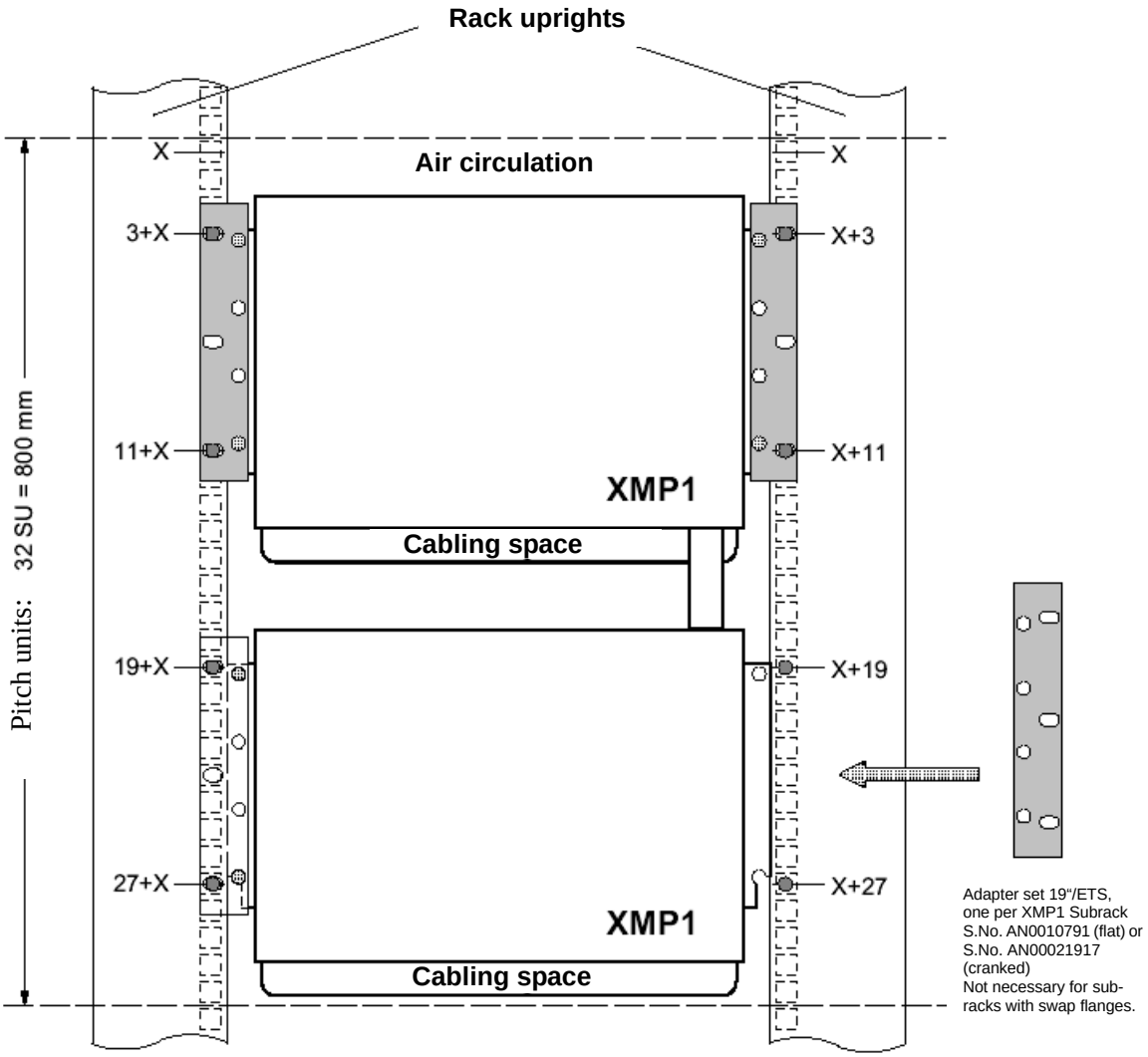
8.6.2 ETS racks

The XMP1 subrack (8), (16) can also be mounted in ETS racks. In this case, it is necessary to exchange the flanges on the left-hand and right-hand side of the XMP1 subrack. These flanges can be turned and are thus appropriate for being mounted both in ETSI and 19" cabinets.

The XMP1 subrack (8), (16) is secured by means of cage nuts.
For more detailed information, please refer to Section 8.7, *XMP1 Subrack Grounding* .

Mounting dimensions in ETS system rack



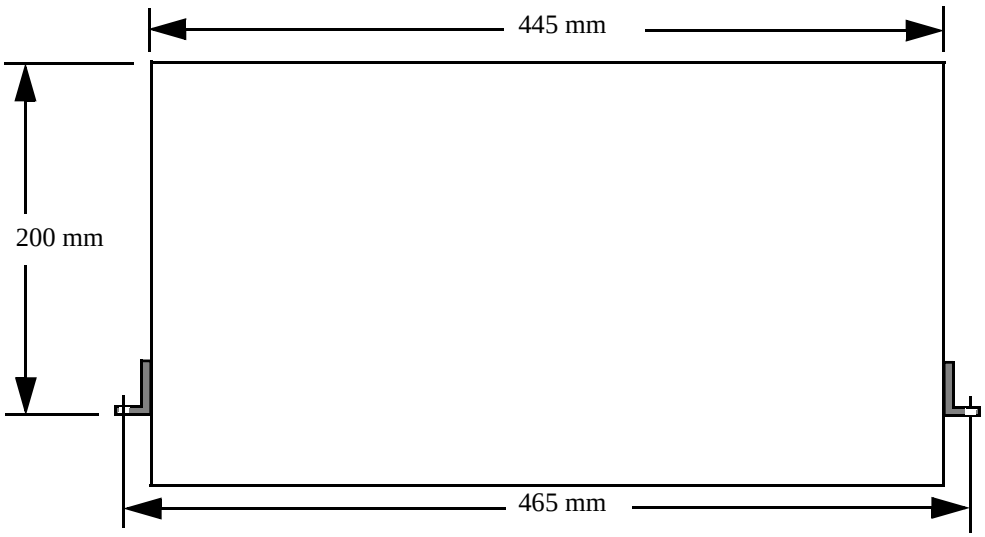

Rack uprights
X
Air circulation
X
3+X
X+3
11+X
X+11
XMP1
Cabling space
19+X
X+19
27+X
X+27
XMP1
Cabling space
Pitch units: 32 SU = 800 mm
Adapter set 19"/ETS, one per XMP1 Subrack S.No. AN0010791 (flat) or S.No. AN00021917 (cranked)
Not necessary for sub-racks with swap flanges.

8.6.3 Remounting the flanges

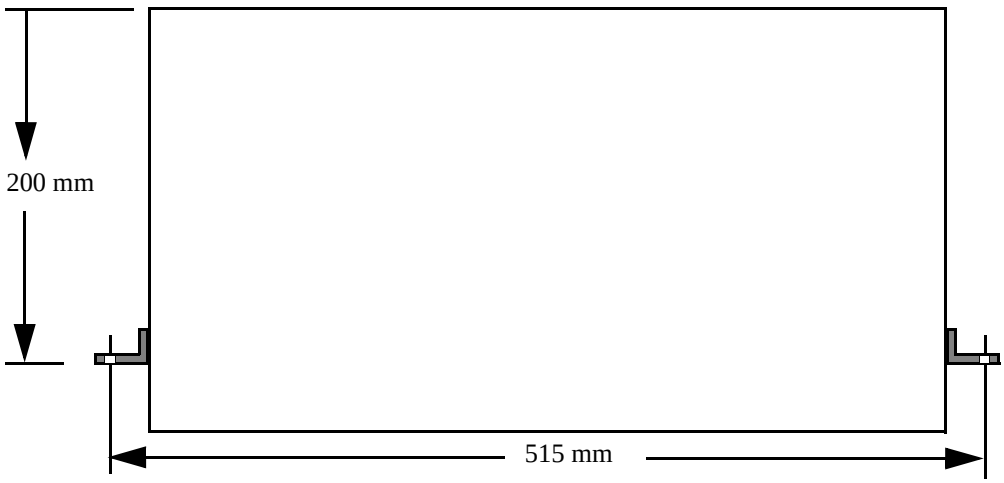
For installation in a 19“ rack or system rack (ETS), the XMP1 subrack (16), (8) is equipped with a mounting flange on its left and right side. In the as-delivered state, these flanges are mounted for installation in a 19“ rack. If the XMP1 subrack shall be installed in a different rack type, the flanges must be remounted to adapt the mounting dimensions correspondingly.

For more information on the mounting dimensions with the different flange positions, please refer to the following drawings:

19“ rack



ETS rack



8.7 XMP1 Subrack Grounding

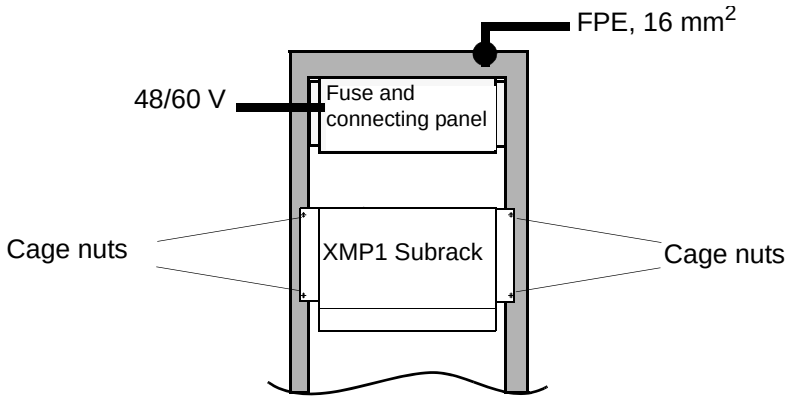
Safety instructions

CAUTION

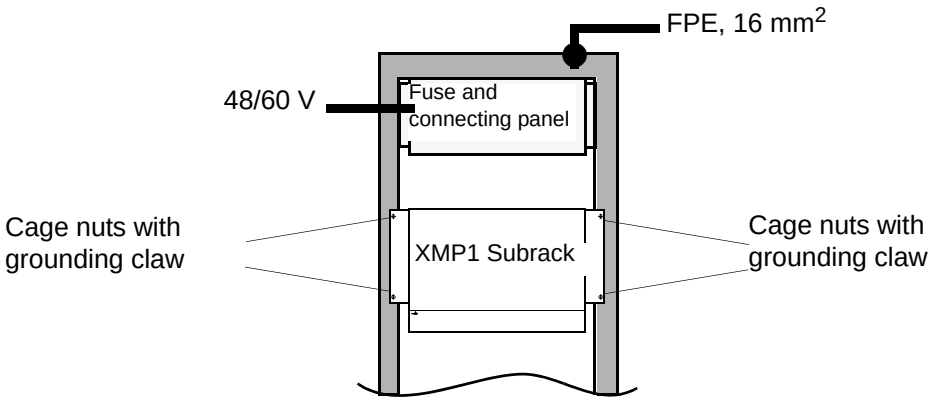
Grounding must comply with the relevant national regulations!
In case of grounded racks or cabinets with unlacquered uprights, use cage nuts for securing the XMP1 subrack.
If the XMP1 subrack is mounted in a grounded rack or cabinet with lacquered uprights, secure it by means of cage nuts with grounding claws.
In case of other mounting variants ground the XMP1 subrack by means of a separate grounding cable.

The rack or cabinet in which the XMP1 subrack is mounted must be connected to the functional and protective earth (FPE) using a 16 mm^2 copper cable.

8.7.1 Installation in a rack or cabinet with unlacquered uprights



8.7.2 Installation in a rack or cabinet with lacquered uprights



8.7.3 Grounding bolt

If the XMP1 subrack is separately mounted or if the conductivity within the housing is not sufficient, a grounding cable must be connected to the XMP1 subrack.
For this purpose the grounding bolt is used.

The grounding bolt is marked by a grounding symbol.

Grounding symbol

Attach the grounding cable using the grounding bolt and connect it to the earth point specified in compliance with the national regulations.

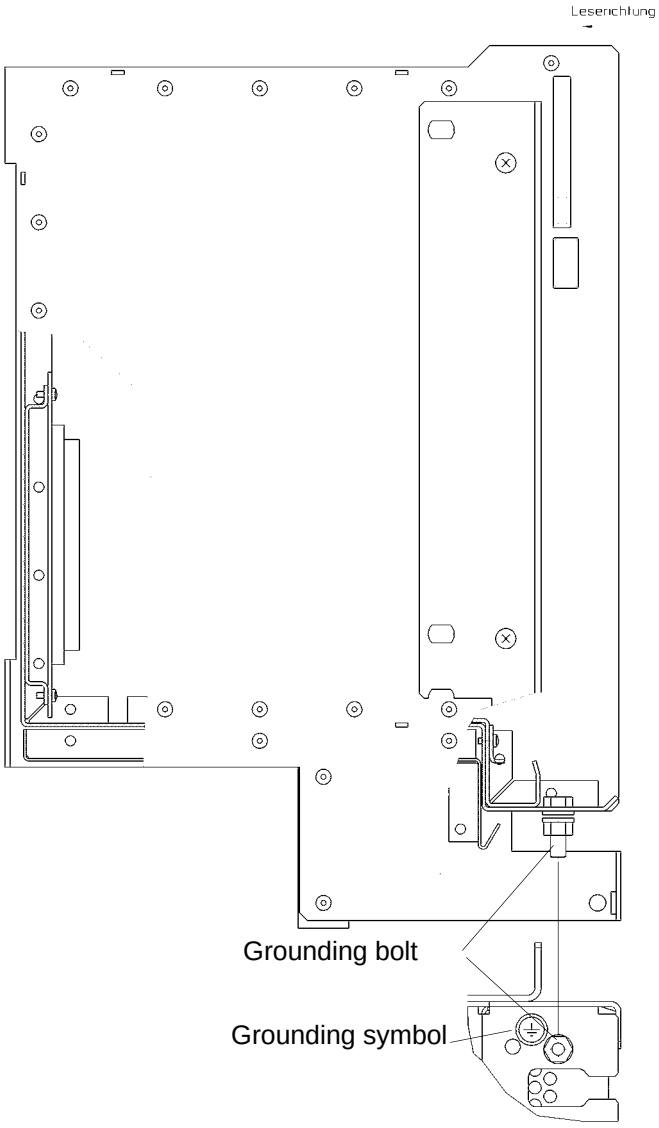


Figure 8.6: Position of grounding bolt

8.8 XMP1-SL

The XMP1-SL (05HAN00499AAC) is composed of a 19“ housing with the following dimensions:

Width: 450 mm

Height: 55 mm

Depth: 300 mm.

The XMP1-SL can be mounted in 19“ and ETSI racks. The unit is equipped with special mounting flanges appropriate for installation in both rack types.

The XMP1-SL cable connections are set up via connectors located on the front side of the unit.

The XMP1-SL offers a card slot which can be equipped with a XMP1 module. This card slot is accessible from the front and closed by means of a cover plate. The connecting cables of the module are routed to the outside via openings on the right-hand side of the cover.

Two further positions located on the main board can be equipped with DSK Modular cards. These cards are connected via X21 and X22 on the front side of the XMP1-SL unit. Assignment between mounting positions and connectors:

- Connector X21 -> lower mounting position
- Connector X22 -> upper mounting position

The seizure of thes connectors depends on the module mounted.

For grounding the XMP1-SL there is a grounding bolt on the left side of the equipment unit.

The supply voltage range of XMP1-SL can be set to 24 V DC or 48/60 V DC. The switch for adjusting this supply voltage range is accessible through a small opening on the left side of the unit.

The PSU-XMP1-SL power supply is mounted in the left-hand section of the main board.

For more detailed information please refer to the Description and Operating Instruction XMP1-SL (05PHA00363AAU).

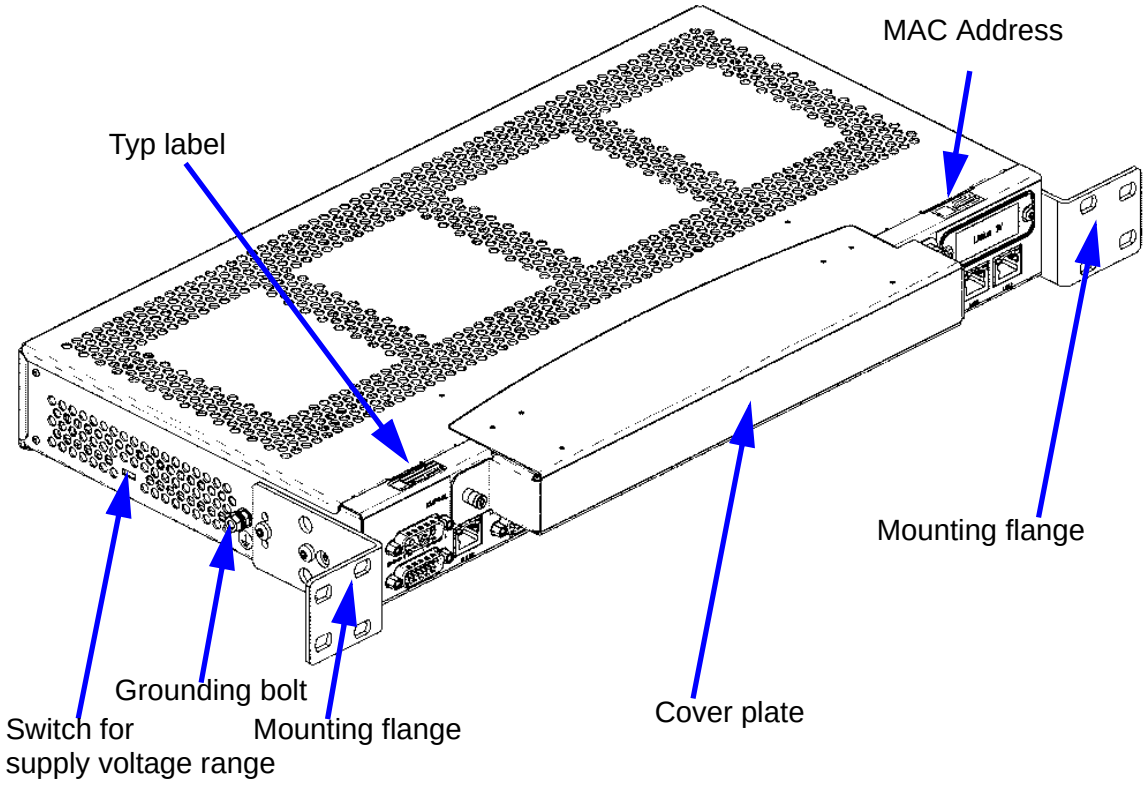


Figure 8.7: XMP1-SL unit

Chapter 9
Technical Characteristics

Table 9.A: General characteristics

9.1 General Characteristics	
Supply voltages	48/60 V DC
Power consumption	depending on equipment with modules
Dimensions (H x W x D)	
19" design	310 x 480 x 235 mm
Card slots	XMP1 subrack (16): 16 card slots XMP1 subrack (8): 8 card slots XMP1 subrack (16/32): 16 (32) card slots

Table 9.B: System parameters

9.2 System Parameters	
Number of 2 Mbit/s interfaces	16
Number of time slots managed	512
Max. number of channels	200
Maximum number of nodes per network	Recommendation: 70 nodes per area
Pulse frame structure	to ITU-T G. 704
Additional synchronization	CRC4 procedure (ITU-T G.706), switchable
Compression	to ITU-T G. 711, law A
Clock supply	External clock, internal clock or recovered receive clocks at the 16 ports or ISDN interfaces
External clock interface	to ITU-T G.703
Number of possible clocks per node	any
Number of possible network clocks	65534
Network clock selection	acc. to priority list
Behaviour with jitter/wander	to ITU-T G.823
Interface to SOX	RS232 Optional Ethernet interface
Interface to SOA	Optional: QD2 interface at QD2 Central Unit (RS485)

Table 9.C: Climatic and EMC conditions

9.3 EMC, Equipment Safety, Climatic Conditions	
9.3.1 Interference emission	
acc. to EN 55022 limiting value class B, EN 300386	
9.3.2 Immunity to noise	
acc. to EN 55024, EN 300386	
9.3.3 Equipment safety	
acc. to EN 60950	
9.3.4 Climatic conditions	
Operation	ETS 300019, Class T3.1e Class 3.2 for modules with drawing no. 62.7040
Storage	ETS 300019, Class T1.1
Transport	ETS 300019, Class T2.1

Table 9.D: Central Unit

9.4 Central Unit	
9.4.1 RS485 interface	
(Only with Central Unit QD2 and Central Unit GN/QD2)	
Electrical features	EIA standard RS-485 (V.11)
Bus system	Serial bus system acc. to EIA-RS 485, half-duplex
Length of drop line to bus subscriber	max. 2.5 m
Maximum bus length	500 m
Bus terminating impedance	120 Ohms
Maximum capacitive load	250 pF
Transmission rate	64 kbit/s
Signal shape	NRZI (Non return to zero inverted)
9.4.2 RS232 interface	
F-interface with SOX and MSP (Central Unit QD2)	
Electrical features	ITU-T Rec. V.24; DIN 66259, part 1
Connector	9-pin Sub-D socket
Maximum length of connecting cable	15 m
9.4.3 Clock interface T3in	
Frequency	2048 kHz
Input impedance	highly resistive, balanced $\geq$1.6 k$\Omega \leq$ 60 pF, switchable to 120 Ohms
Voltage level U_{P0}	1.9 V. . . 0.5 V
9.4.4 Clock interface T3out (T4) to ITU-T G.703, 11/2001	
Frequency	2048 kHz
Input impedance	highly resistive, balanced
Voltage level U_{P0}	1.5 V $\pm$20% across 120 Ohms, resistive
Signal shape	rectangular
Terminating impedance	120 Ω, balanced
Reflection loss	$\geq$16 dB at 2048 kHz across 120 Ω, resistive
9.4.5 Alarm interface	
Alarm contacts for A-alarms and B-alarms	
Maximum switching voltage (SELV circuit)	-60 V
Maximum current	1 A

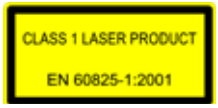
Table 9.D: Central Unit

9.4.6 Ethernet interface (optional with SOX)	
Interface	Provided by Ethernet Adapter and Central Unit Expansion CU-E sub-module
Connector X20	RJ45, 8 pins
Interface acc. to	ANSI/IEEE 802.3, 1996 Edition
9.4.7 EMC	
The unit meets the EMC requirements defined in ETS 300 386-2.	

9.5 SDH Expansion Module SCU

9.5.1 STM-1 interface 155 Mbit/s

Laser class	Laser Class 1



STM-1 interface	Optical acc. to ITU-T G.957 and G.958
Transmission rate	155 520 kbit/s
Code	Binary NRZ (optical interface)
Interfaces on the SCU module	max. 2
Connector type	LC (SFP module)

Application class acc. to G.957:	S1.1	L1.1	L1.2
Transmitter			
Maximum Tx power	– 8 dBm	0 dBm	0 dBm
Range	< 15 km	< 40 km	< 80 km
Wavelength	1300 nm	1300 nm	1550 nm
Wavelength range	1266 . . 1360 nm	1263 . . 1360 nm	1480 . . 1580 nm
Spectral width	< 4 nm	< 1 nm	< 1 nm
Side mode suppression	-	> 30 dB	> 30 dB
Dynamic extinction ratio	8,2 dB	10 dB	10 dB
Maximum Tx power in case of a fault	2 mW	2 mW	2 mW
Receiver			
Maximum optical input power (BER $<10^{-10}$)	– 8 dBm	– 10 dBm	– 10 dBm
Sensitivity	– 28 dBm	– 34 dBm	– 34 dBm

9.5.2 STM-1 interface 155 Mbit/s electrical

STM-1 interface	electrical acc. to ITU G.703
Transmission rate	155 520 kbit/s
Code	CMI (electrical interface)
Impedance	75 Ohms, coaxial
Interfaces on the SCU module	max. 2
Connector type, SFP module	1.0/2.3 mm coaxial

9.5.3 STM-4 interface 622 Mbit/s optical

Laser class	Laser class 1
STM-4 interface	acc. to ITU-T G.957 and G.958
Transmission rate	622 080 kbit/s
Code	binary NRZ (optical interface)
Interfaces on the SCU module	max. 2
Connector type	LC (SFP module)

Application class acc. to G.957:	S4.1	L4.1	L4.2
Transmitter			
Maximum Tx power	– 8 dBm	2 dBm	2 dBm
Range	< 15 km	< 40 km	< 80 km
Wavelength	1300 nm	1300 nm	1550 nm
Wavelength range	1274 . . 1356 nm	1280 . . 1335 nm	1480 . . 1580 nm
Spectral width	< 2,5 nm	< 1 nm	< 1 nm
Side mode suppression	-	> 30 dB	> 30 dB
Dynamic extinction ratio	8,2 dB	10 dB	10 dB
Maximum Tx power in case of a fault	2 mW	2 mW	2 mW
Receiver			
Maximum optical input power (BER $<10^{-10}$)	– 8 dBm	– 8 dBm	– 8 dBm
Sensitivity	– 28 dBm	– 28 dBm	– 28 dBm

9.5.4 2 Mbit/s equipment interface

Interface characteristics	to ITU-T G.703
Impedance, switchable	120 Ohms eff. (bal.) or 75 Ohms coaxial (unbal.), highly resistive
Bit rate	(2048 $\pm$ 5 x 10^{-5}) kbit/s
Period duration T_0	488 ns
Signal code	HDB3
Tx signal shape at F1out	approx. rectangle
Tx signal amplitude at F1out US_0	3 V $\pm$ 10% across 120 Ohms or 2.37 V $\pm$ 10% across 75 Ohms
Permissible Rx signal attenuation at F1in with a center frequency of 1 MHz referred to the Tx signal amplitude at F1out	max. 6 dB
Interfaces on the SCU module	10

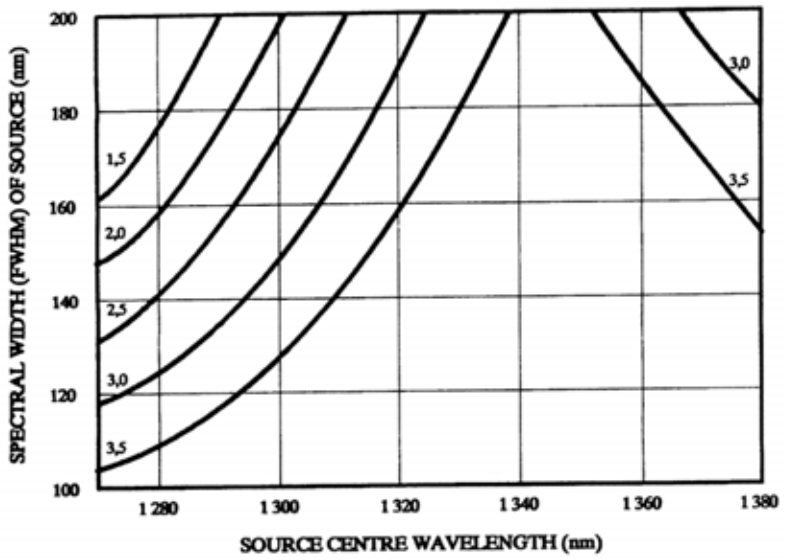
9.6 Interfaces on EoSCU module

9.6.1 STM-1/4 interfaces

See also Section 9.5, *SDH Expansion Module SCU* .

9.6.2 Ethernet interfaces

Number of interfaces	4
9.6.2.1 100Base TX electrical	
RX+, RX-; TD+, TD-	acc. to IEEE 802.3-2002
Insertion loss (1 to 100 MHz), typ.	0.6 dB
Reflection loss	1 to 30 MHz: 16 dB 30 to 100 MHz: 10 dB
Auto MDIX	yes
Connector type	RJ45
Coverage range	100 m
9.6.2.2 STM-1 S1.1 100Base LX10	
Application class according to G.957	S1.1
Transmitter	
Maximum Tx power	– 8 dBm
Coverage range	< 10 km
Wavelength	1310 nm
Wavelength range	1270 . . 1360 nm
Spectral width	< 7,7 nm
Extinction ratio	8.2 dB
Receiver	
Maximum optical input power (BER $<10^{-10}$)	– 8 dBm
Sensitivity	– 28 dBm
9.6.2.3 SFP 100Base FX	
Transmitter	
Maximum Tx power	– 14 dBm
Coverage range	< 2 km
Wavelength	1310 nm
Wavelength range	1270 . . 1380 nm
Extinction ratio	10 dB

Spectral width FWHM 

Receiver	
Maximum optical input power (BER $<10^{-10}$)	– 14 dBm

9.6.3 E1 interfaces

Interface features	acc. to ITU-T G.703
Impedance, switchable	120 Ohms real (bal.), 75 Ohms coaxial (unbal.) and highly resistive
Bit rate	(2048 ± 5 x 10^{-5}) kbit/s
Period duration T_0	488 ns
Signal code	HDB3
Shape of Tx signal at F1out	approximate rectangle
Tx signal amplitude at F1out US_0	3 V ± 10% across 120 Ohms or 2.37 V ± 10% across 75 Ohms
Permissible attenuation of the receive signal at F1in with a center frequency of 1 MHz ref. to the Tx signal amplitude at F1out	max. 6 dB
Total number of EoSCU module interfaces	6 external 2 Mbit/s equipment interfaces Connector X21: 6 interfaces

9.6.4 Clock interfaces (external clock)

Clock interface on connector X22	

9.6.4.1 2048 kHz, T3

Frequency	2048 kHz
Signal shape	acc. to ITU-T G.703
Impedance adjustable	highly resistive, 75 Ohms or 120 Ohms

9.6.4.2 2048 kHz, T4

Frequency	2048 kHz
Signal shape	acc. to ITU-T G.703

Table 9.E: Port interfaces

9.7 Port Interfaces

9.7.1 2 Mbit/s interfaces (ports)

9.7.1.1 2 Mbit/s equipment interface (HDB3 port)

Interface characteristics	to ITU-T G.703
Impedance	120 Ohms resistive (bal.) or 75 Ohms coaxial (unbal.)
Bit rate	2,048 $\pm$ 5 x 10^{-5} kbit/s
Period duration T_0	488 ns
Signal code	HDB3
Tx signal shape at F1out	approx. rectangle
Tx signal amplitude at F1out US_0	3 V $\pm$ 10 % across 120 Ohms or 2.37 V $\pm$ 10 % across 75 Ohms
Permissible Rx signal attenuation at F1in with a center frequency of 1 MHz referred to the Tx signal amplitude at F1out	max. 6 dB
Number of interfaces on the module	2 or 4

9.7.1.2 Port LE2 OPT U

Electrical 2 Mbit/s equipment interface

Interface characteristics	in compliance with ITU-T G.703
Impedance, switchable	120 Ohms resistive (bal.) or 75 Ohms coaxial (unbal.)
Bit rate	(2048 $\pm$ 5 x 10^{-5}) kbit/s
Period duration T_0	488 ns
Signal code	HDB3
Tx signal shape at F1out	approx. rectangle
Tx signal amplitude at F1out	3 V $\pm$ 10 % across 120 Ohms or 2.37 V $\pm$ 10 % across 75 Ohms
Permissible Rx signal attenuation at F1in referred to the amplitude of the Tx signal at F1out at a center frequency of 1 MHz	max. 6 dB
Intrinsic jitter of the Tx signal at F1out	Ajpp/T0 $\leq$ 0.05 (= 24 ns)

Table 9.E: Port interfaces

Optical 2 Mbit/s equipment interfaces	
2F module; 2 Mbit/s optical line interface F1 62.7026.570.00-A001 (AN00120461) 1310 nm	
Laser class	Laser class 1
Transmission path	Fiber-optic cable Single-mode fiber 10/125µm, Multimode fiber 50/125µm, separate fibers for F1in/F1out
Bit rate	(2048 ±2 x 10^{-5}) kbit/s
Baud rate	4096 kBaud
Signal code	MCMI or MCMI inverted
Tx signal shape	Rectangle
Wavelength	1270 nm to 1340 nm
Extinction factor	< 0.1
Average optical transmit power (as-delivered state)	-10 dBm ± 1 dB
Maximum transmit power	< 8.8 mW
Receive level range, (BER <10^{-8})	-8 dBm to -35 dBm
Plug connector type	to DIN, optionally to SC-PC or E2000

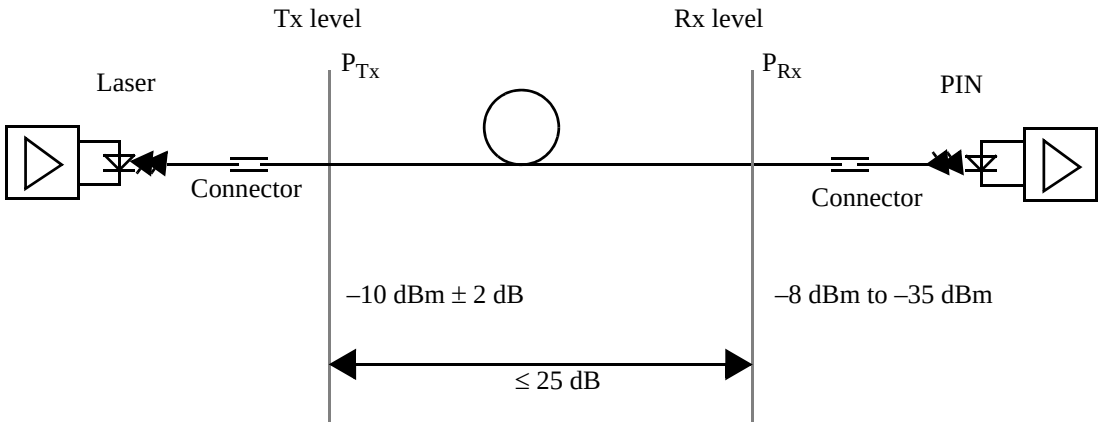


Figure 9.1: Levels at the 2F module

Table 9.E: Port interfaces

2F module; 2 Mbit/s optical line interface F1, 62.7026.540.00-A001 1300 nm	
Laser class	Laser class 1
Transmission path	Fiber-optic cable Single-mode fiber 10/125µm, Multimode fiber 50/125µm separate for F1in/F1out
Bit rate	(2048 ±2x10^{-5}) kbit/s
Baud rate	4096 kBaud
Signal code	MCMI or MCMI inverted
Transmit signal shape	Rectangle
Wavelength	1270 nm to 1340 nm
Extinction factor	< 0.1
Average optical Tx power (as-delivered state)	–10 dBm ±1 dB
Maximum transmit power	<8.8 mW
Receive level range, (BER <10^{-8})	–8 dBm to –53 dBm
Connector type	to DIN, optionally to SC-PC or E2000

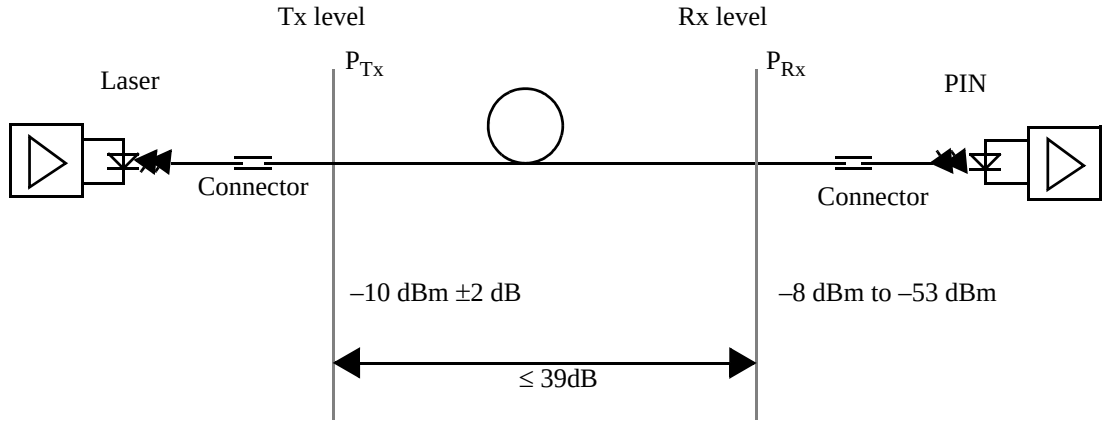


Figure 9.2: Levels at the 2F module

Table 9.E: Port interfaces

1F module; 2 Mbit/s optical line interface F1	
Laser class	Laser class 1
Transmission path	Fiber-optic cable, single-mode fiber 10/125µm, one fiber used for F1in/out
Bit rate	(2048 ± 2 x 10^{-5}) kbit/s
Baud rate	4096 kBaud
Signal code	MCMI or MCMI inverted
Tx signal shape	Rectangle
Wavelength	Version A001: Transmitter 1270 nm to 1350 nm Receiver 1510 nm to 1590 nm
	Version A002: Transmitter 1510 nm to 1590 nm Receiver 1270 nm to 1350 nm
Extinction factor	< 0.1
Average optical transmit power (as-delivered state)	-10 dBm ± 1 dB
Maximum transmit power, version A001	< 8.8 mW
Maximum transmit power, version A002	<10 mW
Receive level range, (BER <10^{-8})	-8 dBm to -35 dBm
Connector type	to DIN, optionally to SC-PC or E2000

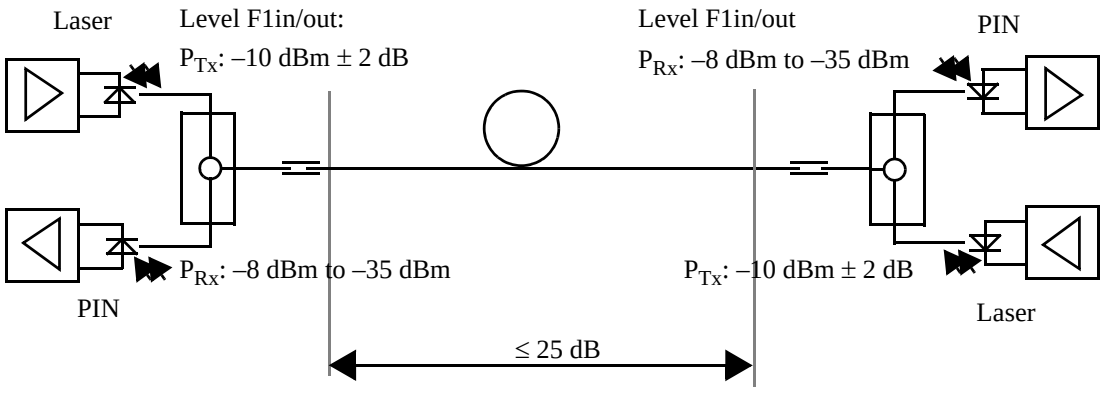


Figure 9.3: Levels at the 1F module

Table 9.F: 34 Mbit/s interfaces

9.7.2 34 Mbit/s interfaces

Table 9.F: 34 Mbit/s interfaces

9.7.2.1 MUX34 KX port	
General version	to ITU-T G.703.8
Transmission bit rate	(34,368 ± 2 × 10-5) kbit/s
Interface code	HDB3
Transmit signal pulse shape	bipolar, approx. rectangular
Impedance at F1in, F1out	75 Ω, resistive
Interface level U_{P0}	1.0 V ± 10 % across 75 Ω
Permissible exchange cable attenuation	0 to 12 dB, at 17,184 kHz
Reflection loss:	
860 kHz to 1,720 kHz	≥ 12 dB
1,720 kHz to 34,368 kHz	≥ 18 dB
34,368 kHz to 51,550 kHz	≥ 14 dB
9.7.2.2 Interface, accessory for MUX34 port module	
8 Mbit/s interface (F2 side)	
Permissible line attenuation at F2in	≤ 6 dB at 1024 kHz
Interface	to ITU-T, G.703.7
Code	HDB3
Bit rate at F2out	8448 kbit/s ±3 x 10^{-5}
Signal shape at F2out	bipolar, approx. rectangle
Signal amplitude at F2out, U_{p0}	nominal 2.37 V across 75 Ω
Impedance at input F2in	75 Ω, resistive (unbalanced)
Permissible line attenuation at F2in	≤ 6 dB at 4224 kHz
2 Mbit/s interface (F2 side)	
Transmit signal pulse shape	bipolar, approx. rectangular
Interface	to ITU-T, G.703.6
Code	HDB3
Bit rate at F2out	2,048 kbit/s ± 5 x 10^{-5}
Signal shape at F2out	bipolar, approx. rectangular
Signal amplitude at F2out, U_{P0}	nom. 3 V across 120 Ω
Impedance at input F2in	120 Ω, resistive (bal.) or 75 Ω (unbal.), switchable

Table 9.F: 34 Mbit/s interfaces

9.7.2.3 Port LE34OPT KX DK	
F1 interface 34GF optical	
Laser class	Laser class 1
Transmission bit rate	(34,368 ± 2 * 10^{-5}) kbit/s
Line code	MCMI (1B/2B)
Wavelength	1,285 nm to 1,330 nm
Baud rate	68,736 kBauds
Transmitter characteristics	
Transmit signal pulse shape	NRZ
Optical transmit element	Low-power single-mode laser
Optical transmit power P_S	–10 dBm ± 0.5 dB *)
Maximum transmit power in case of a fault	<10.2 mW
Extinction factor	< 0.15
Maximum permissible transmit power with interferences and faults	+ 4 dBm
Receiver characteristics	
Input sensitivity	–6 dBm to –39 dBm
Optical receive element	PIN-FET diode
BER from -6 dBm to -41 dBm	1*10^{-10}
Separate plug connector for each transmission direction	DIN connector
F2 interface 34GF electrical	
General version	to ITU-T G.703.8
Interface code	HDB3
Transmission bit rate	(34,368 ± 2*10^{-5}) kbit/s
Signal shape at F1out	rectangular, RZ
Interface level U_{P0}	1.0 V ± 10% across 75 Ω
Impedance at input F1in	75 Ω, resistive (unbal.)
Permissible exchange cable attenuation	< 12 dB at 17,184 kHz
Service channel interface (optional)	
General version	to ITU-T G.703.1.2.1
Transmission bit rate	(64 ± 100 * 10^{-6}) kbit/s
Interface code	to ITU-T, G.703.1.2.1
Interface level	1.0 V ± 10% across 120 Ω

Table 9.F: 34 Mbit/s interfaces

Cable	Balanced conductor pair

Table 9.G: Port nx64

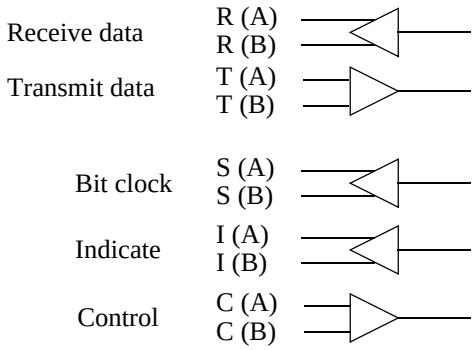
9.7.2.4 Port nx64	
General	
Data bit rate	N x 64 kbit/s, where N=1 to 31 64, 128, 192 . . . . 1984 kbit/s
Transmission of control line	In 64 kbit/s channel or in service digits of PCM frame
V.11 interface data	
Interface definition	to ITU-T X.21
Electrical characteristics	to ITU-T X.27/V.11
Plug connector	15-pin (female) trapezoidal connector (DÜE)
Electrical interface V.11	
Transmitter:	
Output impedance	< 50 Ohms
Output short-circuit current	< 150 mA
Output voltage at log. "1" or OFF, idle run	3.5 V < U < 5.0 V
Receiver:	
Input impedance	150 Ohms, 600 Ohms and highly resistive (approx. 5 kOhms), switchable by means of straps or slide switch
Input differential voltage	< 300 mV
Voltages for control and clock lines	
OFF	≤ -0.3 V
ON	≥ +0.3 V
Voltages for data lines	
Binary value “1“	≤ -0.3 V
Binary value “0“	≥ +0.3 V
Line lengths (terminated line)	between 50 m (n=31) and 1000 m (n=1)
Interface lines	

Table 9.G: Port nx64

V.35 interface data	
Interface definition	ITU-T V.35
Electrical characteristics of control and signalling	ITU-T V.28
Plug connector	25-pin (female) trapezoidal connector (DÜE)
Voltages for clock lines and logic states of data lines	
Logic "1"	- 0.55 V ± 20%
Logic "0"	+ 0.55 V ± 20%
Electrical interface V.28	
Source voltage	approx. ± 9 V, across Ri <300 Ohms
Short-circuit current	typically ±10 mA
Maximum line length	15 m
Voltages for control and signalling lines to ITU-T V.28	
OFF	≤ -3 V
ON	≥ +3 V
Interface lines	

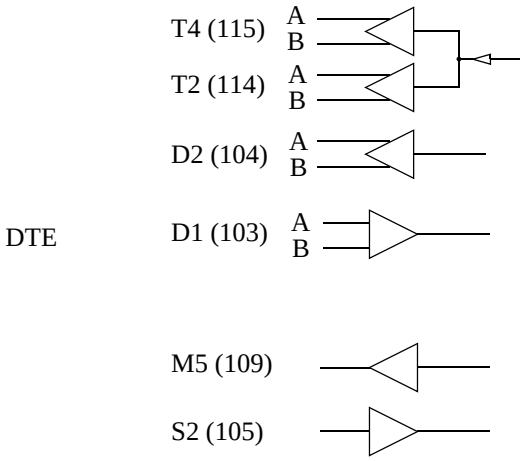


Table 9.H: Port LAN

9.7.2.5 Port LAN	
The Port LAN module (62.7026.360.00-A001/A002) permits remote LAN networks based on Ethernet (IEEE 802.3) to be connected via the XMP1 system.	
Number of Ethernet channels	Module A001: 2 Module A002: 1
Bandwidth	64 kbit/s. . . 1984 kbit/s
Interface 10BaseT	
Frame structure	acc. to IEEE 802.3
Cable type	Twisted pair
Impedance	100 Ohms
Cable length	up to 100 m with a conductor diameter of 0.4 to 0.6 mm
Interface 10Base2	
Frame structure	acc. to IEEE 802.3
Cable type	Coaxial cable
Impedance	50 Ohms
Maximum segment length	185 m
Maximum number of stations per segment	30
Minimum spacing between two stations	0.5 m
Electric strength	
10Base2	In compliance with ISO/IEC 8802-3, section 10.4.2.1: Electric strength between signal ground and coaxial screen: 500 Vac for 1 min. Section 10.7.2.4: Static discharge path: 1 MOhms; 0.25 W, Electric strength: Signal ground ---> Coaxial screen: 750 Vdc
10BaseT	In compliance with ISO/IEC 8802-3, section 14.3.1.1: 1500 Vrms (50, 60 Hz) for 60 sec. in compliance with IEC 950 1991 (corresponds to EN 60950) 2250 Vdc for 60 sec. in compliance with IEC 950 1991 Sequence of 2400 V pulses (1.2/50us) at intervals of >= 1 sec. in compliance with IEC 60.

Table 9.I: KZU channel modules

9.8 KZU Channel Modules

9.8.1 KZU OSX

Number of interface on the module	4, configurable as SUB, EX, OB, OBG
Transmission range for 10dB signal attenuation	with ⌀ 0.4 mm wire: 6.6 km (19.8 km 600 Ohms with addional amplifier) with ⌀ 0.6 mm wire: 12.5 km (37.5 km 600 Ohms with additional amplifier) with ⌀ 0.8 mm wire: 16.7 km (50.1 km 600 Ohms with additional amplifier)

Impedance:

Nom. termination	600 Ohms resist.	Complex , Germany 220 Ohms + (820 Ohms // 115 nF)	Complex, BT 370 Ohms + (620 Ohms // 310 nF)
OB	-	X	-
OBG	X	-	-
SUB	X	X	X
EX	X	X	X

Levels

The following level ranges can be adjusted for all KZU OSX module types:

Level in (Tx direction)	600 Ohms: Complex DTAG: Complex BT:	-9.4 dB ... +6.1 dB -9.3 dB ... +6.0 dB -8.7 dB ... +7.3 dB
Level out (Rx direction)	600 Ohms: Complex DTAG: Complex BT:	-23.6 dB ... +1.9 dB -23.6 dB ... +1.7 dB -23.6 dB ... +1.5 dB

9.8.2 KZU FEK (8)

For 2-wire or 4-wire transmission with E&M signalling and connection of 2-wire or 4-wire PBXs or CF systems.

VF band	300 to 3,400 Hz
Level at F2out (Rx level, digital/analog), adjustable in steps of 0.1 dB	
4-wire 600 Ohms 2-wire 600 Ohms 2-wire complex	+9.0 dBm . . . –15.4 dBm +9.0 dBm . . . –15.4 dBm +1.3 dBm . . . –15.9 dBm
Level at F2in (Tx level, analog/digital), adjustable in steps of 0.1 dB	

Table 9.I: KZU channel modules

4-wire 600 Ohms 1) 2-wire 600 Ohms 2-wire complex	+6.7 dBm . . . –17.4 dBm +7.5 dBm . . . –16.7 dBm +5.1 dBm . . . –17.4 dBm
1) The module is designed so that an additional attenuation of 6 dB can be provided for each channel.	
Impedance F2in/F2out	600 Ohms switchable to Z (220 Ohms + (820 Ohms//115 nF)) with DC isolation (up to 100 V)
Trans-hybrid loss	≥ 12 dB
Signalling	2 x E & M
Number of interfaces on the module	8

9.8.3 KZU SUB (8)

For 2-wire connections of CB subscribers to PBXs in conjunction with the KZU EX channel module.
Operation as extended subscriber: KZU SUB to KZU EX.
Operation as leased line: KZU SUB to KZU SUB.
The subscriber power supply and ringing circuit are integrated on the interface.

VF band	300 to 3,400 Hz
Interface	2-wire, to subscriber
Transmit direction (from telephone) with balancing network:	
600 Ohms:	-10.5 dB to +6.4 dB, adjustable in steps of 0.1 dB
Complex 220 Ohms + (820 Ohms // 115 nF) DTAG:	-12.2 dB to +6.4 dB, adjustable in steps of 0.1 dB
Complex 370 Ohm + (620 Ohms // 310 nF) BT:	-11.5 dB to +6.4 dB, adjustable in steps of 0.1 dB
Receive direction (to telephone) with balancing network:	
600 Ohms:	-17.4 dB to -0.6 dB, adjustable in steps of 0.1 dB
Complex 220 Ohms + (820 Ohms // 115 nF) DTAG:	-17.4 dB to +1.2 dB, adjustable in steps of 0.1 dB
Complex 370 Ohms + (620 Ohms // 310 nF) BT:	-17.4 dB to +0.5 dB, adjustable in steps of 0.1 dB
Nominal impedance	
Impedance, complex	220 Ohms + (820 Ohms // 115 nF) DTAG or 370 Ohms + (620 Ohms // 310 nF) BT
Impedance, resistive	600 Ohms (software-selectable)
Signalling	Loop signalling or MFC
Meter pulse	12 or 16 kHz, 2 Vrms
Ringing frequency	16 2/3, 25 or 50 Hz
Ringing voltage	55 to 60 V_{rms}

Table 9.I: KZU channel modules

Number of interface on the module	8

9.8.4 KZU EX (8)

For 2-wire connections of CB subscribers to PBXs in conjunction with the KZU SUB channel module. The receivers for feeding current, ringing signals and meter pulses are integrated on the interface.

VF band	300 to 3400 Hz
Interface	2-wire, to exchange
Transmit direction (from exchange) with balancing network:	
600 Ohms:	-8.0 dB to +7.5 dB, adjustable in steps of 0.1 dB
Complex 220 Ohms + (820 Ohms // 115 nF) DTAG:	-10.8 dB to +8.0 dB, adjustable in steps of 0.1 dB
Complex 370 Ohms + (620 Ohms // 310 nF) BT:	-9.4 dB to +8.0 dB, adjustable in steps of 0.1 dB
Receive direction (to exchange) with balancing network:	
600 Ohms:	-20.7 dB to +3.8 dB, adjustable in steps of 0.1 dB
Complex 220 Ohms + (820 Ohms // 115 nF) DTAG:	-18.8 dB to +3.2 dB, adjustable in steps of 0.1 dB
Complex 370 Ohms + (620 Ohms // 310 nF) BT:	-20.5 dB to +3.1 dB, adjustable in steps of 0.1 dB
Nominal impedance	
Impedance, complex Impedance, resistive	220 Ohms + (820 Ohms // 115 nF) for DTAG or 370 Ohms + (620 Ohms // 310 nF) for BT 600 Ohms (software-selectable)
Signalling	Loop signalling or MFC
Meter pulse	12 or 16 kHz, switchable on module
Ringing frequency, Rx range	16 to 64 Hz
Number of interfaces on the module	8

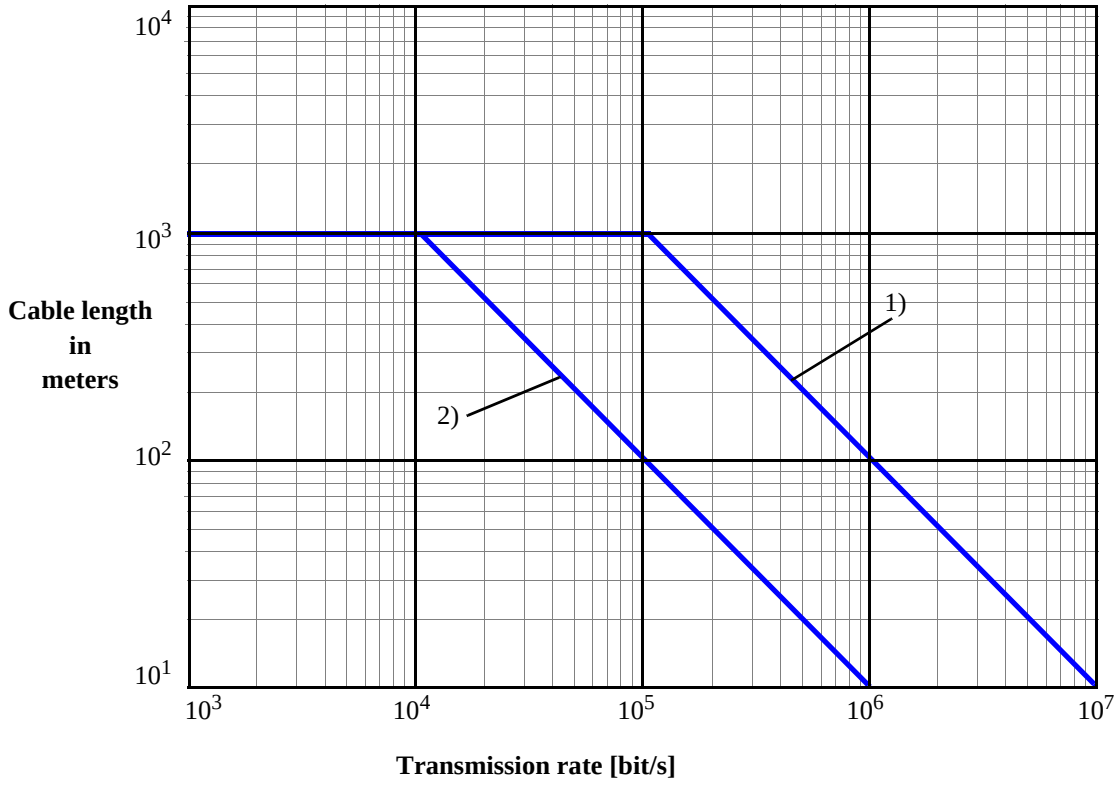
1) Software-adjustable in steps of 0.1 dB

Table 9.J: DSK Modular

9.9 DSK Modular	
Basic board for equipment with four modules (appropriate for V.24, V.11, V.35, WT and G.703 modules)	
9.9.1 Mechanical dimensions	
DSK-Modular basic board	170 mm x 256 mm
V.11, V.24, V.35, G.703 and WT modules	125 mm x 55 mm
9.9.2 Immunity of interface lines to noise (indoor application)	
Standards	EN 50082, ETS 300 386-2
Transient, low-energy pulse groups (bursts)	
Bursts on DC power supply lines	± 500 V
Bursts on indoor control and data lines	± 500 V
Transient, high-energy pulses of a 1.2/50µs and 10/700µs shape	
Voltage pulses on DC power supply lines	± 500 V
9.9.3 V.11 module	
Interface data	
Standards	EN 50082, ETS 300 386-2
Interface definition	in compliance with ITU-T X.21
Electrical features	in compliance with ITU-T V.11 or X.27
Number of interfaces on the module	2
Electrical V.11 interface	
Transmitter	
Output impedance	< 50 Ohms
Output short-circuit current	< 150 mA
Output voltage with log. "1" or OFF, idle run	3.5 V < U < 5.0 V
Receiver	
Input impedance, switchable	150 Ohms, 600 Ohms and approx. 5 kOhms
Input differential voltage	< 300 mV
Assignment of line conditions	
Line	Voltage U (a) -> U (b):
Control and clock line status	≤ -0.3 V corresponds to "OFF" condition
Data line status	≤ -0.3 V corresponds to "1"
Control and clock line status	≤ -0.3 V corresponds to "ON" condition
Data line status	≥ + 0.3 V corresponds to "0"

Table 9.J: DSK Modular

Cable length:



1): Terminated interface line
2): Interface lines not terminated

Asynchronous transmission	
Data rate	0 to 19.2 kbit/s, transparent
Oversampling possible at	8 kHz, 16 kHz, 32 kHz and 64 kHz
Control signals	only with 64 kHz sampling rate
Signal distortion	≤ 25 % without R.111, with R.111 ≤ 6.25 %
Transmission with frame structure in compliance with ITU-T V.110	
Synchronous (full-duplex)	
Data rate	600 bit/s 1200 bit/s 2400 bit/s 4800 bit/s as 8 kbit/s stream acc. to V.110 9600 bit/s as 16 kbit/s stream acc. to V.110 19200 bit/s as 32 kbit/s stream acc. to V.110 48 kbit/s as 64 kbit/s stream acc. to V.110

Table 9.J: DSK Modular

Asynchronous (transparent) with oversampling	
Data rate	0 to 1200 bit/s as 8 kbit/s stream acc. to V.110 (sampling rate: 4800 Hz) up to 2400 bit/s as 16 kbit/s stream acc. to V.110 (sampling rate: 9600 Hz) up to 4800 bit/s as 32 kbit/s stream acc. to V.110 (sampling rate: 19200 Hz) up to 9600 bit/s as 64 kbit/s stream acc. to V.110 sampling rate: 48 kHz)
Signal distortion	≤ 25 % without R.111, with R.111 ≤ 6.25 %
Synchronous (full-duplex n ∗ 64 kbit/s, n =1 to 8)	
Data rate	Synchronous (full-duplex) 64 kbit/s 128 kbit/s 192 kbit/s 256 kbit/s 320 kbit/s 384 kbit/s 448 kbit/s 512 kbit/s

9.9.4 V.24 module

Interface data	
Interface definition	in compliance with ITU-T V.24
Electrical characteristics	in compliance with ITU-T V.28
Number of interfaces on the module	2
Electrical V.28 interface	
Source voltage	approx. ± 9 V, across Ri < 300 Ohms
Short-circuit current	typically ± 10 mA
Maximum line length	15 m
Assignment of line conditions	
Control and clock line status	≤ -0.3 V corresponds to "OFF" condition
Data line status	≤ -0.3 V corresponds to "1"
Control and clock line status	≥ +0.3 V corresponds to "ON" condition
Data line status	≥ +3V corresponds to "0"
Asynchronous transmission	
Data rate	0 to 19.2 kbit/s, transparent
Oversampling possible at	8 kHz, 16 kHz, 32 kHz and 64 kHz
Signal distortion	≤ 25 % without R.111, with R.111 ≤ 6.25 %

Table 9.J: DSK Modular

Transmission with frame structure acc. to ITU-T V.110 synchr. (full-duplex)	
Synchronous (full-duplex)	
Data rate	Synchronous (full-duplex) 600 bit/s 1200 bit/s 2400 bit/s 4800 bit/s as 8 kbit/s stream acc. to V.110 9600 bit/s as 16 kbit/s stream acc. to V.110 19200 bit/s as 32 kbit/s steam acc. to V.110
Transmission with frame structure acc. to ITU-T V.110 asynchr. (transparent) with oversampling	
Data rate	Asynchronous (transparent) with oversampling 0 to 1200 bit/s as 8 kbit/s stream acc. to V.110 (sampling rate: 4800 Hz) up to 2400 bit/s as 16 kbit/s stream acc. to V.110 (sampling rate: 9600 Hz) up to 4800 bit/s as 32 kbit/s stream acc. to V.110 (sampling rate: 19200 Hz) up to 9600 bit/s as 64 kbit/s stream acc. to V.110 (sampling rate: 48 kHz)
9.9.5 V.35 module	
Interface data	
Data and clock lines	in compliance with ITU-T V.35
Control and signalling lines	in compliance with ITU-T V.28
Number of interfaces per module	2
V.35 interface data	
Voltages for clock lines and logic states of data lines	
Logic "1"	≤ -0.55 V across R_L=100 Ohms
Logic "0"	≥ +0.55 V across R_L=100 Ohms
Electrical V.28 interface	
Source voltage	min. 5 V across R_L=3 kOhms to GND
Short-circuit current	max. ± 100 mA
Maximum line length	15 m
Voltages for control and signalling lines acc. to ITU V.28	
OFF	≤ -3V
ON	≥ +3V
Asynchronous transmission	
Data rate	0 to 19.2 kbit/s, transparent
Oversampling possible at	8 kHz, 16 kHz, 32 kHz and 64 kHz
Control signals	only with 64 kHz sampling

Table 9.J: DSK Modular

Signal distortion	≤ 25 % without R.111, with R.111 ≤ 6.25 %
Transmission with frame structure acc. to ITU-T V.110	
Synchronous (full-duplex)	
Data rate	600 bit/s 1200 bit/s 2400 bit/s 4800 bit/s as 8 kbit/s stream acc. to V.110 9600 bit/s as 16 kbit/s stream acc. to V.110 19200 bit/s as 32 kbit/s stream acc. to V.110 48 kbit/s as 64 kbit/s stream acc. to V.110
Signal distortion	≤ 25 % without R.111; ≤ 6.25% with R.111
Synchronous (full-duplex) n * 64 kbit/s, n =1 to 8	
Data rate	Synchronous (full-duplex) 64 kbit/s 128 kbit/s 192 kbit/s 256 kbit/s 320 kbit/s 384 kbit/s 448 kbit/s 512 kbit/s
Transmission with frame structure acc. to ITU-T V.110 **Asynchronous (transparent) with oversampling**	
Data rate	0 to 1200 bit/s as 8 kbit/s stream acc. to V.110 (sampling rate: 4800 Hz) up to 2400 bit/s as 16 kbit/s stream acc. to V.110 (sampling rate: 9600 Hz) up to 4800 bit/s as 32 kbit/s stream acc. to V.110 (sampling rate: 19200 Hz) up to 9600 bit/s as 64 kbit/s stream acc. to V.110 (sampling rate: 48 kHz)
Signal distortion	≤ 25 % without R.111, with R.111 ≤ 6.25 %

Table 9.J: DSK Modular

9.9.6 G.703 module, codirectional	
Interface data	
Number of interfaces per module	2
Data lines	in compliance with ITU-T G.703
Line port D2	4-wire, balanced
Impedance	120 Ohms, resistive
Reflection loss at 15 kHz to 150 kHz	>16 dB
Signal code	pseudo-ternary
Bit rate	64 kbit/s
Baud rate	256 kBauds
Pulse shape of the Tx signal at D2out	approx. rectangle
Amplitude of the Tx signal at D2out (nominal value) U_{p0}	1 V ± 0.1 V
Permissible attenuation of the Rx signal at D2in referred to the Tx signal at D2out (128 kHz)	max. 3 dB
Unbalance loss at D2out from 10 kHz to 1 MHz	≥ 30 dB
9.9.7 G.703 module, contradirectional	
Interface data	
Number of interface per module	2
Data lines	in compliance with ITU-T G.703
Line port D2	4-wire, balanced
Impedance	120 Ohms, resistive rms
Reflection loss from 1.6 kHz to 3.2 kHz from 3.2 kHz to 64 kHz from 64 kHz to 96 kHz	 >12 dB >18 dB >14 dB
Signal code	pseudo-ternary
Bit rate	64 kbit/s
Transmit signal pulse shape at D2out	approx. rectangle
Transmit signal amplitude at D2out (nominal value) U_{p0}	1 V ± 0.1 V
Permissible Rx signal attenuation at D2in referred to the Tx signal at D2out (at 32 kHz)	max. 3 dB
Unbalance loss at D2out at 10 kHz to 1 MHz	≥ 30 dB
Pulse width - data Pulse width - clock	15.6 us 7.8 us

Table 9.J: DSK Modular

9.9.8 WT module	
Interface data	
Number of interfaces per module	2
Data rate	Asynchronous 0 to 9.6 kbit/s, transparent with 64 kHz oversampling
Data rate	up to 2.4 kbit/s with 16 kHz oversampling
Oversampling at	8 kHz, 16 kHz, 32 kHz and 64 kHz
Maximum signal distortion at 9600 bit/s and 64 kbit/s oversampling	≤ 15%
Electrical characteristics	
Sampling circuit	Separated via optocoupler
Input circuit	Double- and single-current interface
Input impedance of the input circuit	
at –1 V U_{SAMPLE} 7 V	1 kOhms ± 10%
at 3 V ≥ U_{SAMPLE} < 7 V	3 kOhms ± 10%
Response threshold	1.2 V to 2.8 V
Output circuit	Push-pull final stage isolated via optocoupler
Internal impedance Ri	300 Ohms ± 10%
External voltage	
External voltage	± UW (± 12V/± 24V) must be applied externally

Table 9.K: ISDN channel modules

9.10 ISDN Channel Modules

9.10.1 ISDN S0F

The ISDN S0F modules (with remote power supply) are used for setting up duplex point-to-point connections between ISDN PBXs via XMP1 or as subscriber extension of a PBX.

Bit rate	192 kbit/s
Interface	4-wire, capable for bus operation
Impedance	100 Ω
Number of interfaces on the module	4

9.10.2 ISDN UQF (4) UK0(Q)

The transmission procedure used is the standardized ISDN echo cancellation procedure.
The 2B1Q code with remote power supply is available.
Using the ISDN UK0Q module, it is possible to set up a UK0-UK0 or Uk0-S0 connection between private branch exchanges (PABX-PABX) via XMP1 systems. Two UK0 interfaces interconnected via the XMP1 system ensure the information exchange between e.g. 2 NTBAs or 2 PABXs required for this purpose.

Code	2B1Q
Baud rate	80 kBauds
Impedance	135 Ohms
Interface	2-wire, echo compensation
Remote power supply	optional
Number of interfaces on the module	4

9.11 Signal Concentrator

9.11.1 Power supply

Supply voltages	+7 V, +5.1 V - premating
DC/DC converter input voltages ± UB	35 to 75 V
Converter input voltage ± UB	12V or 24V + or - pole tied to ground, switchable

9.11.2 Equipment safety

Requirements	EN 60 950

9.11.3 EMC

EMC requirements	EN 300 386
Radio interference	DIN EN 5022
Immunity to EMC interference	DIN EN 50 024
EMC railway systems	EN 50 121-4

EMC protection signal transmission units	EN 60 834-1
9.11.4 Sensors	
Number of sensors	16
Permissible operating voltage	< 60 V
Polarity	any
Residual voltage without detection	< 4 V
Sensor voltage with detection	> 7 V, < 8.5 V
Sensor supply voltage	12 V or 24 V, adjustable in common
Current limiting in sensor circuit	>1 mA and < 2.5 mA
Max. loop resistance	<1500 Ohms with 12 V < 5000 Ohms with 24 V
Debouncing time	approx. 100 ms to 6.4 s, configurable
9.11.5 Transmitters	
Number of transmitters	8
Closed contact	
Minimum current	0.1 mA
Maximum current	1 A
Impedance	<0.1 Ohms
Open contact	
Maximum DC voltage	> 60 V
Max. residual current	< 1µA

Tab. 9.L: Video modules

9.12 Video modules	
9.12.1 Video interfaces	
Number of interfaces per module	2
Interface type	2 x FBAS/CVBS inputs on video encoder 2 x FBAS/CVBS outputs on video decoder
Connector	BNC, 75 Ohms
Video encoding/decoding	
Encoding algorithm	H.261
Video format	288 lines x 352 pixels (full-CIF)
Refresh rate	7.5; 10; 15; 25; 30 or 50 images/s
Data rate	nx64 kbit/s (n=1 to 15)
9.12.2 E1 interface	
E1 (2Mbit/s)	2.048Mbit/s

Tab. 9.L: Video modules

Impedance	120 Ohms balanced or 75 Ohms unbalanced
Tx signal amplitude across 120 Ohms	3 Vpp acc. to G.703
- Cable length at a level of 6 dB	100 m
Tx signal amplitude across 75 Ohms	2.37 Vpp acc. to G.703
- Cable length at a level of 6 dB	20 m
Clock signals	internally recovered from the XMP1 system
Connectors	9-pin SUB-D (front side) with M3 pin
9.12.3 Data/Control interfaces Data1/Ctl and Data2	
Number of data interfaces	2 per board
Number of control interfaces	1 per board
Data interfaces	RS-232C or RS-485 (two-wire), configurable
Protocol	transparent
Format	1 start bit, 8 data bits, 1 parity bit, 1 stop bit
Data rate	1200 bit/s, 2400 bit/s, 4800 bit/s, 9600 bit/s, 19200 bit/s
Data 1/Control interface	Data or control interface
Control interface	RS232 or RS485
Signals	RxD, TxD, ground
Data rate	19200 bit/s
Connectors	2 x 9-pin SUB-D (front panel) with M3 pin
9.12.4 Light-emitting diodes	
3 LEDs for diagnostic purposes	Power (green) Connect (yellow) Error (red)
9.12.5 Standard and recommendations	
This module meets the following ITU-T recommendations: G.703, G.704, G.706, G.732, H.261.	

Tab. 9.M: SDSL Line Equipment

9.13 SDSL Line Equipment

9.13.1 ISHDSL module

9.13.1.1 SDSL interface

Interfaces per module	4
Standards	ETS TS 101 524 and ITU-T G.991.2 Annex B
The following interface modes are supported:	4 x 1 pair SHDSL (3..32 channels or unstructured) 2 x 1 pair SHDSL to (2x 2Mbit/s) 1 x 1 pair SHDSL to (2x 2Mbit/s) + 2 x 1 pair SHDSL (3..32 channels or unstructured)
Coding	TC-PAM16 Trellis-coded pulse amplitude modulation
Data rate	nx64 kbit/s (192....2048 kbit/s)
Impedance	135 Ohms
Transmit power	+13.5 dBm
Overvoltage protection	acc. ITU-T K.20/K.21
Connector	SuB-D, 15 pin male

9.13.1.2 2 Mbit/s interface (Inhouse)

Interfaces per module	4
Standard	ITU-T G.703
Operating mode	2048 kbit/s transparent or structured ITU-T G..704
Coding	HDB-3
Data rate	E1 fractional mode nx64 kbit/s with TS16 transmission
Impedance	120 Ohms, balanced 75 Ohms, unbalanced
Jitter performance	ITU-T G..823, Output jitter optimized for SDSL series switching
ESD protection	8 kV
Connector	Sub-D 25 pin

9.13.1.3 Power supply

Power supply (DC) via backplane	- 48 V DC to - 60 V DC
Power consumption	0.19 A
Power consumption UB	0.16 A
Power dissipation	8.7 W

9.13.1.4 Mechanical dimensions

Length x width	256 mm x 170 mm

Tab. 9.M: SDSL Line Equipment

Weight	396 g
9.13.1.5 Interface classification acc. to EN 60950-1	
SHDSL interface (X600)	TNV-3
E1 interface (X500)	TNV-1
RPS (X601)	TNV-3
9.13.1.6 Environmental conditions	
Operation	acc. ETS 300 019 Class 3.2
Transport	acc. ETS 300 019 Class 2.1
Storage	acc. ETS 300 019 Class 1.1
Operating altitude max.	3000 m
9.13.1.7 Safety	
Standards applied	EN 60950-1, EN 41003
9.13.1.8 EMC	
Standards applied	EN 55022, Class B, EN 55024, EN 50121-4, EN 300 386, ITU Red Book Vol. III, FacsIII.3, Suppl. No. 27

9.13.2 RPS-XMP1 Remote Power supply module

9.13.2.1 Output voltages

Output	FSP 1, FSP 2, FSP 3 and FSP 4
Nominal voltage [V]	-116
Tolerance range [%]	±3
Nominal load [A]	0.09
Pin tied to ground	+

9.13.2.2 Remote supply ranges

Wires used	No. of Repeater	Coverage range with ∅ 0.9 mm	Coverage range with ∅ 1.2 mm	Coverage range with ∅ 1.4 mm
1 DA	1	19.2 km	36 km	49 km
1 DA	2	2 * 6,6km	2 * 12 km	2 * 16 km
1 DA	3	3 * 2.9 km	3 * 5.3 km	3 * 7.2 km

9.13.2.3 Supply voltage

Nominal voltage	-48V / -60V DC voltage
Tolerance range	-36V DC to -75V DC
Nominal input current	-48 V DC: 1.1 A -60 V DC: 0.9 A
Upstream fuse	External automatic circuit breaker up to 4 A T (time-lag) in each ungrounded pole of the power supply.

9.13.2.4 Mechanical dimensions and weight

Length x width in mm	256 x 170
Weight	426 g
Operating altitude max.	3000 m

9.13.2.5 Interface classification acc. to EN 60950-1

UB -48/60 V	TNV-2
+FSPx, -FSPx	TNV-3
Signal output SIG	SELV

9.13.2.6 EMC

In conjunction with the XMP1 system, the RPS XMP1 remote power supply module complies with the relevant EMC guidelines (interference emission and immunity to interference)	DIN EN 55022 – Limiting Value Class B DIN EN 55024 ETSI EN 300 132-2 DIN EN 50 121-1 DIN EN 50 121-4 ETSI EN 300 386 DIN EN 60 870-2-1

9.13.2.7 Safety	
Safety of information technology equipment	EN 60950-1
9.13.2.8 Environmental conditions	
Operation	acc. ETSI EN 300 019-1-3 Environment Class 3.2 in the XMP1 system
Storage	acc. ETSI EN 300 019-1-1 Environment Class 1.1
Transport	acc. ETSI EN 300 019-1-2 Environment Class 2.1

Table 9.N: Power supply

9.14 Power supply

9.14.1 PSU-XMP1

Nominal voltage U_i	48 V and 60 V
Voltage range U_i	35 V to 75 V
Nominal current 48/ 60 V	8 A
Operating voltages	+7 V, +5 V, -8.5 V
Board dimensions	256 mm x 190 mm
Premating fuse	External circuit breaker 10 A T in each ungrounded supply voltage pole.

Table 9.O: XMP1-SL

9.15 XMP1-SL	
9.15.1 Mechanical dimensions	
Length x width x Height [mm]	450 x 300 x 55
Weight	approx. 3.55 kg
Operating altitude	3000 m
Card slots	Card slot for one XMP1 Module
	2 card slots (internal) for DSK Modules
9.15.2 Environmental data	
9.15.2.1 Climate	
Storage	acc. ETS 300 019 Class 1.2
Transport	acc. ETS 300 019 Class 2.1, 2.3 with specific packaging
Operation	acc. ETS 300 019 Class 3.2, without bedewing.
9.15.2.2 EMV	
EMV Standards	EN 55022, Class B EN 55024 EN 300 386
9.15.2.3 Safety	
acc.	EN 60950-1 EN 41003 EN 60825-1, Laser class 1 (optional modules)
9.15.3 Interface classification acc. to EN 60950-1	
Power supply	TNV-2
Datenschnittstellen	SELV
T3, T4	SELV
E1	SELV
Q (LAN)	SELV
F (RS232)	SELV
LAN 1, LAN 2	SELV
Alarm	SELV
Optical Port IF, optional	Laser class 1
9.15.4 Power supply	
Power supply voltage	24/48/60 V DC
Power supply voltage range	18 to 75 V DC
Leistungsaufnahme bei 48 V (ohne zusätzliche Baugruppenbestückung)	10 W

Table 9.O: XMP1-SL

Grounding	Plus- or minus pole, preferably plus pole
External automatic circuit breaker	At each ungrounded pole of the power supply, the XMP1-SL supply voltage must be protected by an external automatic circuit breaker of up to 6 A T (slow-blow).
9.15.5 Clock interfaces	
Connector type	9-pin SubD, male
9.15.5.1 2048 kHz, T3	
Frequency	2048 kHz
Signal shape	acc. ITU-T G.703
Impedance	highly resistive (>1,6 kOhm), 75 Ohms or 120 Ohms
9.15.5.2 2048 kHz, T4	
Frequency	2048 kHz
Signal shape	acc. ITU-T G.703
Impedance	highly resistive (>1,6 kOhm), 75 Ohms or 120 Ohms
9.15.6 Alarm interface	
Alarm contacts for A-alarms and B-alarms	
Maximum switching voltage (SELV circuit)	-60 V
Maximum current	1 A
9.15.7 E1 interfaces (Inhouse)	
Number of interfaces	8
Connector type	37-pin SubD, male
Interface characteristics	acc. ITU-T G.703
Impedance	120 Ohms resistive (bal.), 75 Ohms coaxial (unbal.) or highly resistive < 1.6 kOhms
Bit rate	$(2048 \pm 5 \times 10^{-5})$ kbit/s
Period duration T0	488 ns
Signal code	HDB3
Transmit signal shape at F1out	approx. rectangle
Transmit signal amplitude at F1out (line) US_0	3 V ± 10% across 120 Ohm or 2,37 V ± 10% across 75 Ohm
Permissible attenuation of the receive sigal with a center frequency of 1 MHz, referred to the amplitude of the transmit signal at F1out (line)	max. 6 dB

Table 9.O: XMP1-SL

9.15.8 XMP1 modules

2 MBIT/S PORTS	
Port (4), with 4 HDB3 interfaces, 120 Ohms and 75 Ohms	62.7026.350.00-A001 AN00059056
Port (2), with 2 HDB3 interfaces, 120 Ohms and 75 Ohms	62.7026.353.00-A001 AN00059057
Port Nx64k with V.11 interface	62.7040.340.00-A001 AN00218363
Port Nx64k with V.11/V.35 interfaces	62.7040.340.00-A002 AN00224736
Port LE2 OPT U	62.7026.530.00-A001 AN00043311
- Module 2F (1270 to 1340 nm)	62.7026.570.00-A001 AN00120461
- Module 1F (Transmitter: 1270 to 1330 nm; Receiver: 1510 to 1590 nm)	62.7026.580.00-A001 AN00120463
- Module 1F (Transmitter: 1510 to 1590 nm; Receiver: 1270 to 1330 nm)	62.7026.580.00-A002 AN00120464
Port LAN, with two channels 10BaseT	05HAT00051AAH
Port LAN, with one channel 10BaseT	05HAT00051ABA
VIDEO MODULES	
Video encoder (2 x video-in)	05HAT00063AAC
Video decoder (2 x video-out)	05HAT00062AAA
KZU CHANNEL INTERFACE MODULES	
KZU FEK (8), with eight interfaces	62.7040.250.00-A001 AN00113903
KZU OSX, 4 interfaces configurable as SU, EX, OB and OBG	05HAT00035AAL
KZU SUB (8), with eight interfaces	05HAT00073AAS
KZU EX (8), with eight interfaces	62.7040.210.00-A002 AN00274683
DSK DATA INTERFACE MODULES	
DSK modular, basic board for mounting 4 modules of any type	62.7040.400.00-A002 AN00228158
-Module V.11, two V.11 interfaces	62.7040.405.00-A001 AN00098224
-Module V.24, two V.24 interfaces	62.7040.410.00-A001 AN00098225
-Module V.35, two V.35 interfaces	62.7040.415.00-A001 AN00098226

Table 9.O: XMP1-SL

-Module G.703, two G.703 interfaces	62.7040.420.00-A001 AN00098228
-Module WT, two WT interfaces	62.7040.425.00-A001 AN00099104
-Module G.703 contradirectional, two G.703 interfaces	62.7040.435.00-A001 AN00227950
ISDN INTERFACE MODULES:	
ISDN S0F, with remote power supply and four interfaces	62.7040.610.00-A001 AN00102511
ISDN UK0F (Q), with remote power supply and four interfaces	62.7040.670.00-A001 AN00111549
ISHDSL INTERFACE MODULE:	
ISHDSL, with 4 interfaces	05HAT00070AAL
SIGNAL CONCENTRATOR	
Signal concentrator	62.7040.180.00-A001 AN00275454

9.16 Planning Values - Power Supply/Thermal Loss

Legend: * withdrawn modules

Table 9.P: Planning values for power supply and thermal loss of modules

SHORT DESIGNATION	MODULE TYPE	THERMAL LOSS IN WATT	POWER SOURCE/ A			POWER SINK / A		
			–UB	+ 7 V	**–8 V**	–UB	+ 7 V	**–8 V**
POWER SUPPLY MODULES								
60V	**Power supply II 48/60 V**	**15.0**	**3.5**	**7**	**4**	**-**	**-**	**-**
60V *	Power supply 48/60 V	**12.0**	**3.0**	**5.0**	**2.7**	**-**	**-**	**-**
FSP *	top/bottom	**6.0**	**-**	**-**	**-**	**0.5**	**-**	**-**
FSo *	FSP top	**3.0**	**-**	**-**	**-**	**0.3**	**-**	**-**
FSu *	FSP bottom	**3.0**	**-**	**-**	**-**	**0.3**	**-**	**-**
24V *	Power supply 19-35 V	12.0	-	5.0	2.7	-	-	-
WND *	Converter 19-75 V	35.0	3.0	-	-	-	-	-
CENTRAL UNITS								
ZTQ	**QD2ZT with QD2**	**4.8**	**-**	**-**	**-**	**-**	**1.1**	**0.1**
ZTC	**QD2ZT CC w/o QD2**	**4.8**	**-**	**-**	**-**	**-**	**1.1**	**0.1**
ZTG	**QD2ZT GN w/o QD2**	**4.8**	**-**	**-**	**-**	**-**	**1.1**	**0.1**
ZT2	**QD2ZT doubled**	**4.8**	**-**	**-**	**-**	**-**	**1.1**	**0.1**
ZCC *	CC CrossConnect	4.0	-	-	-	-	0.6	-
ZGN *	GN basic network	4.0	-	-	-	-	0.6	-
ZKV *	KV channel distributor	4.0	-	-	-	-	0.6	-
CC2 *	CC doubled	4.0	-	-	-	-	0.6	-
SCU (SDH-CORE UNIT)								
SCU		17				0.28		
EoSCU		23,28				0,48		
EoSCU with 2 x opt. SDH-SFPs + 4 x opt. Ethernet-SFPs		28				0,58		
PORT MODULES 2 MBIT/S								
Po2	**Port HDB3 (2)**	**2.5**	**-**	**-**	**-**	**-**	**0.3**	**-**
Po4	**Port HDB3 (4)**	**2.5**	**-**	**-**	**-**	**-**	**0.3**	**-**

Table 9.P: Planning values for power supply and thermal loss of modules

SHORT DESIGNATION	MODULE TYPE	THERMAL LOSS IN WATT	POWER SOURCE/ A			POWER SINK / A		
			–UB	+ 7 V	**–8 V**	–UB	+ 7 V	**–8 V**
LE2 *	Port LE CU (2)	2.5	-	-	-	-	0.3	-
LE4 *	Port LE CU (4)	2.5	-	-	-	-	0.3	-
LEU *	LE, unframed (4)	2.5	-	-	-	-	0.3	-
PDK *	Port DK (4)	2.5	-	-	-	-	0.3	-
PORT MODULES 2 MBIT/S OPTICAL								
LOU	**Port LEOPT U + 2 opt. modules**	**10**	**-**	**-**	**-**	**-**	**0.9**	**0.4**
-	**- Port LE opt U**	**2.5**	**-**	**-**	**-**	**-**	**0.4**	**0.05**
-	**- Module 2F (25 dB)**	**1.0**	**-**	**-**	**-**	**-**	**0.15**	**-**
-	**- Module 1F**	**1.0**	**-**	**-**	**-**	**-**	**0.15**	**-**
	- Module 2F (39 dB)	**3.0**	**-**	**-**	**-**	**-**	**0.2**	**0.2**
	- Module 1F *	**3.0**	**-**	**-**	**-**	**-**	**0.2**	**0.2**
LO1 *	Port opt (1)	2.5	-	-	-	-	0.2	0.2
LO2 *	Port opt (2)	5.0	-	-	-	-	0.3	0.4
PORT MODULES 34 MBIT/S								
M34	**MUX 34 KX**	**9.0**	**-**	**-**	**-**	**-**	**0.7**	**0.55**
L34	**LE 34opt KX**	**9.0**	**-**	**-**	**-**	**-**	**0.9**	**0.3**
IF	**IF 2/8 to MUX34**	**4.0**	**-**	**-**	**-**	**-**	**0.6**	**-**
PORT NX64								
N64	**Port n*64**	**3.0**	**-**	**-**	**-**	**-**	**0.9**	**-**
LAN MODULES								
LAP	**LAN (1) as Port**	**4.9**	**-**	**-**	**-**	**-**	**0.48**	**0.19**
LAP	**LAN (2) as Port**	**8**	**-**	**-**	**-**	**-**	**0.72**	**0.37**
LAU	**LAN (1) as converter**	**4.9**	**-**	**-**	**-**	**-**	**0.48**	**0.19**
LAU	**LAN (2) as converter**	**8**	**-**	**-**	**-**	**-**	**0.72**	**0.37**
KZU CHANNEL MODULES								
OSX	**KZU OSX (4)**	**6**				**0,2**	**0,6**	**0,02**
FEK	**FEK KZU II**	**5.5**	**-**	**-**	**-**	**-**	**0.35**	**0.35**
SUB	**SUB KZU II (8)**	**6.5**	**-**	**-**	**-**	**0.25**	**0.36**	**-**
EX	**EX KZU II**	**3.2**	**-**	**-**	**-**	**-**	**0.45**	**0.02**
OBG *	KZU OB party-line	8.0	-	-	-	0.1	0.3	0.1

Table 9.P: Planning values for power supply and thermal loss of modules

SHORT DESIGNATION	MODULE TYPE	THERMAL LOSS IN WATT	POWER SOURCE/ A			POWER SINK / A		
			–UB	+ 7 V	**–8 V**	–UB	+ 7 V	**–8 V**
6/8 +	6/8 KZU TELEBRAS	5.5	-	-	-	-	0.35	0.35
2WR *	2WR KZU TELEBRAS	6.0	-	-	-	-	0.4	0.4
E&M *	E&M KZU	4.6	-	-	-	-	0.25	0.35
FEK *	FEK KZU	5.5	-	-	-	-	0.35	0.35
SUB *	SUB KZU subscriber	14.0	-	-	-	0.2	0.35	0.15
EX *	EX KZU exchange	4.0	-	-	-	-	0.25	0.05
OB *	OB KZU local battery	6.0	-	-	-	0.1	0.3	0.1
DR2 *	DR2 KZU EB5	11.0	-	-	-	0.2	0.3	0.1
DR4 *	DR4 KZU	5.5	-	-	-	-	0.35	0.35
ATZ *	ATZ FEK	5.5	-	-	-	-	0.35	0.35
ADPCM *	ADPCM	5.5	-	-	-	-	0.35	0.35
DSK CHANNEL MODULES								
MDG	**Mod. DSK G703, worst case**	**5.0**	**-**	**-**	**-**	**-**	**0.7**	**-**
-	**DSK modular w/o modules**	**1.0**	**-**	**-**	**-**	**-**	**0.1**	**-**
-	**Module G703 codir.**	**0.5**	**-**	**-**	**-**	**-**	**0.06**	**-**
-	**Module G703 contra**	**1.0**	**-**	**-**	**-**	**-**	**0.15**	**-**
MDV	**Mod. DSK V24 V35 V11 WT, worst case**	**8.2**	**-**	**-**	**-**	**-**	**1.1**	**-**
-	**Mod. DSK Vx w/o modules**	**1.0**	**-**	**-**	**-**	**-**	**0.10**	**-**
-	**Module V.11**	**1.0**	**-**	**-**	**-**	**-**	**0.15**	**-**
-	**Module V.24**	**0.7**	**-**	**-**	**-**	**-**	**0.08**	**-**
-	**Module V.35**	**1.8**	**-**	**-**	**-**	**-**	**0.25**	**-**
-	**Module WT**	**1.8**	**-**	**-**	**-**	**-**	**0.05**	**-**
64k *	DSK 64kb/s cod.	5.0	-	-	-	-	0.4	0.1
V24 *	DSK V24/V28	4.0	-	-	-	-	0.4	-
X21 *	DSK X21/V11	3.0	-	-	-	-	0.3	-
WT *	DSK double current	10.0	-	-	-	0.3	0.3	0.3

Table 9.P: Planning values for power supply and thermal loss of modules

SHORT DESIGNATION	MODULE TYPE	THERMAL LOSS IN WATT	POWER SOURCE/ A			POWER SINK / A		
			–UB	+ 7 V	**–8 V**	–UB	+ 7 V	**–8 V**
VEX *	DSK V24/V28ext	3.0	-	-	-	-	0.3	-
V35 *	DSK V.35	4.0	-	-	-	-	0.4	-
ISDN CHANNEL MODULES								
S0F	**S0F (4) with FSP**	**8.0**	**-**	**-**	**-**	**0.42**	**0.25**	**-**
UQF	**UK0 (Q) (4) with FSP**	**10.0**	**-**	**-**	**-**	**0.4**	**0.6**	**-**
UP0 *	without FSP	2.0	-	-	-	-	0.4	-
UPF *	with FSP	5.0	-	-	-	0.2	0.4	-
S0 *	without FSP	2.0	-	-	-	-	0.4	-
S0F *	S0 with FSP	5.0	-	-	-	0.2	0.4	-
UKQ *	UK0 (Q)	5.0	-	-	-	0.2	0.4	-
UKT *	UK0 (T)	5.0	-	-	-	0.2	0.4	-
MISCELLANEOUS								
SIG	**Signal concentrator**	**3.3**	**-**	**-**	**-**	**0.1**	**0.3**	**-**
EA	**Exp. signalling**	**3.3**	**-**	**-**	**-**	**0.1**	**0.3**	**-**
DIX	**DIX QD2ZT add-on**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
QD2 *	QD2 adapter	2.8	-	-	-	-	0.4	-
VIDEO MODULES								
Video encoder	VIE	7.3				0.12	0.01	0.02
Video decoder	VID	5.9				0.1	0.01	0.02
SHDSL MODULES								
ISHDSL	SHD	8.7				0.16	0.19	
RPS-XMP1	RMS							

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